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# The Builder

AN

## ✣ ILLUSTRATED ✣ WEEKLY ✣ MAGAZINE ✣

FOR THE

## ARCHITECT, ENGINEER, ARCHÆOLOGIST, CONSTRUCTOR, SANITARY REFORMER, AND ART-LOVER.

CONDUCTED BY

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FELLOW OF THE ROYAL INSTITUTE OF BRITISH ARCHITECTS.

"Every man's proper mansion-house, and home, being the theater of his hospitality, the seate of selfe-fruition, the comfortablest part of his own life, the noblest of his sonne's inheritance, a kinde of private princedome, nay, to the possessors thereof, an epitome of the whole world, may well deserve, by these attributes, according to the degree of the master, to be decently and delightfully adorned."

"Architecture can want no commendation, where there are noble men, or noble mindes."—Sir Henry Wotton.

"Our English word To Build is the Anglo-Saxon Byldan, to confirm, to establish, to make firm and sure and fast, to consolidate, to strengthen; and is applicable to all other things as well as to dwelling-places."—Diversions of Purley.

"Always be ready to speak your mind, and a base man will avoid you."—William Blake.

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# The BUILDER

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### *Architectural Illustration.*

NOT very many years ago the question of the best method of illustrating architectural works in an architectural journal was of necessity a very simple one. There was practically but one available method, that of engraving on wood from a drawing furnished to the engraver, or drawn for him on the wood by the architectural draughtsman. Steel-engraving was for the most part out of the question for periodicals appearing at regular and short intervals, both from the time required to produce the work, and from its costly nature; which latter factor especially would render it commercially impossible, unless as a rarity and in special instances, for any but monthly or quarterly publications giving a comparatively small number of illustrations. Accordingly, for a long time wood-engraving was the recognised medium by which the works of the architect were translated into pictorial illustration for further publicity.

Certain disadvantages are inseparable, no doubt, from this method of illustration. Though so much cheaper and a good deal more expeditious than steel engraving, it is still, under all the circumstances of weekly journalism, a costly and a slow process, and it is one which will not bear being hurried. A more definite drawback to it, from the architect's and artist's point of view, is that it introduces between the original drawing and the final result another hand than that of the original draughtsman: it is not a reproduction of his drawing, but a translation of it into another form. The introduction of lithography offered the means of reproducing the exact styles and artistic manner of the original draughtsman, but this did not make very much way as long as it was weighted by the necessity of drawing on the stone itself. The old system of chalk drawing on a stone with a fretted surface was, indeed, a pleasant one enough to the draughtsman, and allowed all possible freedom of hand; but it is a style of representation eminently unsuited for architectural subjects, except for the representation of ancient or ruinous architecture, in which picturesque effect is the object rather than the clear definition of architectural design and detail in its perfect state; and drawing with a pen or a fine brush on the stone is not a process favourable to freedom of hand or breadth of effect: some practice, too, is necessary to acquire facility in the process of drawing the reverse way on the stone. The introduction of "transfer paper" got over this last difficulty, and enabled the ordinary architectural draughtsman to make his drawing as it was to be finally seen; but it gave him a surface medium even more uninviting than the stone, with the chance of some loss of sharpness and effect in the process of transference. With the introduction of photolithography, whereby the drawing made on paper with ordinary pen and ink could be almost absolutely reproduced line for line and mark for mark, came an important and entirely new opening in the possibilities of architectural illustration. The process was both cheaper and more expeditious than engraving, and the draughtsman's own style and technique appeared in multiplied form with little diminution of its original effect. In some cases, we might say, photolithography afforded even an improvement on the original drawing by its capability of reducing scale, by which a drawing which originally may have appeared somewhat coarse in execution, acquired in reduction an appearance of delicacy and finish which the original draughtsmanship did by no means convey. This trust in the refining powers of photographic reduction is not, however, to be recommended as a principle of working. To trust to that is to foster artistic indolence and carelessness, as well as to lead to possible disappointment in the final result; for photolithography is capricious in its behaviour in this respect, and sometimes unexpectedly revenges itself on the draughtsman who trusts too much to its kindness in hiding or refining away his deficiencies.

Photolithography, however, has become a great power in architectural illustration, but the many advantages connected with its use have led in many quarters to an exaggerated and perfectly unfair depreciation of wood-engraving as a means of illustration. This has been carried so far that many architects seem to think that the mere fact of an illustration being a wood-engraving is sufficient to render it unworthy their notice. They seem even to forget that as there is good and bad pen drawing, so there is good and bad wood-engraving. This is, of course, mere prejudice, and hardly worth arguing with; but to those who are more reasonable, we may suggest that there are certain undeniable powers and advantages in wood-engraving, which are not to be had by the more recently advanced processes. One practical merit is in the superior certainty and facility of production in large quantities. The printings from a carefully-cut wood-block are far more uniform and certain in result than those from a lithographic stone, when impressions are counted by thousands, and they are produced far more quickly, as far as the mere printing is concerned. In fact, the number of impressions required for a journal like this

could not be produced in reasonable time, except by transferring the impressions and working in duplicate, and such transference involves the risk of some diminution of sharpness and clearness of line. But there are definite artistic points in which carefully-executed wood-engraving has the superiority. It gives a force of effect in contrasts of light and shadow surfaces which can hardly be attained in lithography without a blurred and blotted appearance; it can attain a hardness and brilliancy of texture and sharpness of line which is eminently favourable to the representation of architecture. This, of course, means when it is carefully executed from clean and precisely-defined drawings or photographs. We may safely instance in this respect the engraving of the exterior of Keble College, in the present number; and as another example, those of the Post-office buildings at Rostock, in Germany, in the *Builder* for April 19, 1884. Both these examples were executed in the *atelier* of Mr. J. D. Cooper, from very clear and well-defined photographs; and the engravings may fairly be said to rival the photographs in clearness of definition, giving at the same time more force of contrast of light and shade. But similar results cannot be expected, of course, when the engraver is not given clear and well-defined originals, whether drawings or photographs, to work from. Another important advantage which engraving has over photolithography from pen drawings, is in the capacity for producing distance and middle-distance tints. In lithography nothing but greater fineness of line can be relied on for distant effect; and as the ink always spreads more or less on the stone, lines which are fine enough in the original drawing come out coarser and thicker on the stone, and in consequence it is hardly possible in lithographed line-drawing to keep the distance or the sky in their places; they always obtrude in such a way as to lose atmospheric effect. In wood engraving the lines do not spread in this way, and (what is a much more important point) the wood-engraving is treated by "over-lays," as they are called, of various thicknesses of paper on the opposing surface, by which the paper is pressed on to the block, so as to print the darker parts more heavily and the distant portions lightly. The first impression of an engraving, before it is "brought up" by this treatment, is a very different thing from the final impression.*

The ordinary processes of photolithography, however, still left the necessity of producing coloured drawings or photographs by engraving. The beautiful processes called "autotype" and "photogravure" are, from their costliness and slow production, quite out of the question for weekly journalistic illustration. But the perfection by Messrs. Sprague, not very long since, of their "ink-photo" process, was a most important step in facilitating architectural illustration. This process produces a facsimile of a water-colour drawing so far as balance of tone (not colour) is concerned, or of a photograph, at no exorbitant cost, and, as worked by the firm who have introduced it, with great regularity and certainty of production, and in a time not much longer than is required for ordinary photolithography. We give in the present number two examples of their work; one, the stained-glass design by Mr. Burne Jones, reproduced from a photograph; the other, the west front of Tewkesbury Abbey, from a sepia drawing. The process spreads a stipple-like grain over the surface, which in some classes of subjects assists the effect materially; in the Tewkesbury Abbey plate, for example, it actually adds a surface texture to the masonry which materially improves the effect. Essentially it is, therefore, not so suitable for reproducing line drawing; the line tends to lose its sharpness, and the process is a little capricious in this way. We have seen some examples recently in which lines were produced with great sharpness; but something depends on the tone of the paper. If this is at all of a bluish white, it tends to enhance sharpness of line, as the natural tone of the paper disappears from the result; if the paper employed is at all of a tendency to buff or yellowish tint, this asserts itself in the photographic impression, and gives a more or less blurred effect. In reproducing from photographs, the best results are obtained from those which give opposed masses of light and shadow, and shaded and modelled surfaces, rather than sharply-defined lines or details. Hence it is exceedingly successful in reproducing sculpture photographs; and one eminent sculptor, when we illustrated some of the sculpture in the Academy last year by this process, wrote to us to say that he had never had one of his works so well illustrated. In the treatment of water-colour drawings, of course, the reproduction is subject to the usual difficulties of photography; blues become faint or disappear, yellows become dark, and so on. A coloured drawing which is not made for the purpose of reproduction in this way, therefore, may considerably surprise and disappoint the author if he is not alive to the behaviour of various colours under photography. A sepia drawing, however, can always be trusted to come out well under the process.

It may be useful to add a word as to line drawings for ordinary photolithography, in which mistakes are sometimes made which lead to disappointment. In the first place, consideration should be given to the degree of reduction in size (if any) which is intended. If a large drawing is intended to be reduced, for instance, to one-half or one-third its original size, lines for shading must not be drawn so close that in the reduction they may tend to run into each other: inattention to this often leads to great disappointment in the effect of the lithograph. Spaces which are shaded heavily, unless quite black, should nevertheless be shaded in distinct and clear lines, leaving the interspaces, however small, of untouched white; to scribble or scumble over such shadows with thin lines to give more depth, as some draughtsmen do, is fatal to the lithographic effect, and produces only a "mess" on the plate. It is still supposed by some draughtsmen that drawings must be in black ink for photo-lithography; this is a mistake,—red, or warm brown, such as sepia, take equally well; but it is important that when black ink is used it should be *quite* black; thinly-mixed ink gets grey, which is an approach to blue, and fails accordingly. For the same reason, ordinary writing ink, which some people like to use for pen-drawing, and which produces a very pleasing effect in the original drawing, is exceedingly risky for photolithography, and should never be used with that object.

We give an example in this number of another photographic method of reproducing coloured drawings in the view of Callendar House, which is a reproduction from a sepia sketch, made mainly for the purpose of experiment. The process, which is carried on in Paris by Messrs. Boussod & Co. (late Goupil), results in the production of a metal engraving in very low and delicate relief, which, mounted on a block, is printed in the same manner as a wood-engraving. As will be seen, the process spreads a grain or stipple over the surface, but in a more mechanical kind of manner than in Sprague's process, and so far inferior. The reproduction of *coloured* drawings by this method, being by means of photography, is subject to the same partial falsification of effect which enters into all the processes in which photography is used; but the provision of a reproduction of this kind, which will print like an engraving, is often a great convenience. The present plate reproduces very well the effect of the sepia sketch. We have the proof by us of a better and more effective example which it was intended to print with this, but our Parisian friends have not yet acquired those virtues of certainty and punctuality of delivery which so admirably characterise our leading London lithographers, and the block has not arrived in time for press.

The use of new processes, or those which have not been in habitual use for weekly publications, we have found to be in other cases somewhat hampered by difficulties in regard to speedy and prompt execution. These things arrange themselves in time, however, and further developments in this direction may be looked for, our object being to have for each class of architectural drawing its best and most artistically favourable method of reproduction.

* We may add, however, that our experience leads us to discourage wood engraving for small views of large buildings, where the details are necessarily shown to a very small scale. The material is not pliant enough to work detail on a small scale.

## THE TEMPLE OF DIANA, EPHESUS.

BY J. T. WOOD, F.S.A.

ALTHOUGH the chief results from the discovery of the Temple of Diana at Ephesus have now been before the public for some years in the book I published on the subject in 1877, wherein I described the discoveries made by excavations under the auspices of the Trustees of the British Museum, between the years 1863 and 1874, much remains to be told appertaining to those discoveries, and something more may be added as the results of the excavations which I carried on by private subscription under a committee of noblemen and gentlemen from March, 1883, to February, 1884, excepting the three summer months during which no men can be found to work for a continuance in the pestilential district of Ephesus. Even at the time when the city was in the height of its glory and magnificence, Ephesus was unhealthy by reason of an immense marsh, which all the four rivers which flowed through the plain were not capable of draining, and, we are distinctly told by Strabo, that the Temple was built on a marsh; but now that the city is entirely deserted and consists of nothing more than a number of heaps of ruins of its public buildings, and the river banks being no longer maintained, the whole plain is silted up to a considerable depth, and the marsh north of the city is a source of malaria, which makes its neighbourhood more unhealthy than that of any other of the ruined cities in Asia Minor.

The deadly fever which prevails at Ephesus is one of the great difficulties which present themselves to the explorer who seeks to unearth the treasures of antiquity which lie hidden so many feet below the present surface of the ground.

If it had not been for the fever, I should have carried on the excavations at the Temple during the summer months.

For the first three years of my explorations I worked on without cessation, although I could only get a small gang of men to work for a few days at a time during the hot weather. At the same time, I made my survey of the city, and my life was nearly sacrificed at the end of the third hot season.

But, besides the fever, there are other reasons why the exploration of the Temple cannot go on so well during the summer. The rains in February, March, and April cause the water to rise in the excavations to a height of several feet above the pavement on which rest all the sculptured marble and fragments of architecture which are scattered all over the site. A wet season considerably aggravates this difficulty, and makes it impossible to do more from May to September than to remove the upper strata in preparation for a harvest which can only be reaped in the autumn and winter months.

There is still another difficulty during the summer. Brigandage is rife all over Asia Minor, and the neighbourhood of Ephesus is a favourite resort for the brigands, who are formed in bands of from four or five to twenty-five. These men can live comfortably up in the mountains during the warm months, and the nature of the country is extremely favourable to their evasion of pursuit when they have succeeded in making prisoners, who are taken for a ransom. Even during the winter months I have been obliged for some years to provide myself with a body guard of four cavasses. These men were extremely useful as gangers at the time when I had more than 300 men at work.

The marbles acquired by the excavations during the five years in which I was employed in clearing the site of the Temple are now

arranged in the gallery in the British Museum, which has been recently cleared out for their accommodation, and which has been for so many years the Mausoleum Gallery; so the remains of two of the seven wonders of the ancient world have found their home in our National Collection of Grecian Antiquities.

In the Ephesian Gallery will be seen the sculpture on the south side, the architecture on the north. I should have preferred a *vice-versâ* arrangement, and would have taken the south light for the sculpture; but my opinion and wishes did not prevail.

The mutilated remains of five sculptured drums are ranged in line; and although they stand much nearer together than they did in the Temple itself, they give the *imaginative* visitor some faint idea of the rich effect which a group of eighteen sculptured columns would have as they were arranged in the pronaos and the posticum of the Temple. The most complete of the five sculptured drums in the Museum is 6 ft. 0½ in. in diameter; but the one next to it, with the upper halves of two figures, is only 5 ft. 6½ in. in diameter. I am obliged, therefore, to conclude that these columns were sculptured to about one-third of their height. The different style of sculpture in these drums is most remarkable.

At each end of the gallery, on a line with the sculptured drums, are two very interesting sculptured blocks, each with an enriched bed mould: the character of these blocks, and the positions in which they were found, induce me to believe that they were the angle blocks of a sculptured frieze. This is a question which can only be cleared up by further excavations. On the upper surface of these blocks are to be seen traces of a curved line, which prove, I think, that they were cut out of the drums of columns of an earlier temple. Opposite the central sculptured drum may be seen the remains of the base of one of the fluted columns, which belonged to the outer line of columns of the peristyle on the south side of the Temple; upon a similar base, I presume, the sculptured columns were placed. The great beauty of the outline of this base is most striking. It is probable that between the two astragals, which are here three times repeated, there was a fillet of gold. I had the good fortune to find an example of two astragals of the same size, which had between them a thin strip of lead doubled, and pressed firmly in between the astragals, and within the folded lead were the remains of a strip of thin gold, which must have formed a narrow fillet. The flutings of the columns were elliptical, and the points from which the extremities of the ellipse were struck were set in 1 in. from the face of the fillet dividing the flutings, the arrises therefore were extremely sharp. The acute angle here, and in the marble fillets of the base which divided the cavetti from the astragals, as well as in many other fragments, is most remarkable. Such work could only be executed with the material of which the Temple was built. On showing a sample of this marble to a London marble merchant, he said that it was too hard to be worked in the present day, even by machinery, and it was quite unmarketable.

On a line with the base I have here described there are two examples of the noble capitals which surmounted the fluted shafts of the columns; in both examples the whole of the abacus has been chopped away, but I fortunately found a fragment of another capital with a portion of the abacus remaining. It consisted of the egg-and-tongue enrichment, 6 in. deep. The eye of the volute of one of the capitals has been cut out, and two pin-holes show that a coloured or gilded disc was inserted to complete the volute. In the other example the eye has not been cut out, and the compass-points remain from which the volute was described; each perfect revolution consisted of eight arcs of circles struck from centres with increasing radii from the eye of the volute.

A large fragment of the architrave was found consisting of three fasciæ and what remains of the capping of the upper fascia. The latter has been so much chopped away that it is impossible to restore even the outline, much less the enrichments of which it was composed. It is much to be deplored that nothing has been found of the cornice but two fragments of the beautiful cymatum, 2 ft. in depth, which is enriched by the honeysuckle ornament, deeply and artistically cut. The largest of these was found in the earlier excavations; the other, which enables me to obtain a correct outline of the whole, was found recently near the spot where the first was found. The gutter for the rain-water cut in this stone shows exactly where the lions' heads occurred which formed the water-spouts. These were placed immediately over the columns.

For lack of the parts I have mentioned it is impossible to restore the order, or to fix the places for the numerous varieties of the bead and reel enrichment which were scattered far and wide with a few ogee and other enrichments. Some of these were of a very large size, and many of them retained traces of colour, which justify me in concluding that the whole of the Temple was painted, excepting, perhaps, some of the fillets which might have been left white. On the same site were found the remains of three temples, built one over another, and, as far as I could ascertain, of the same size, but differing in their details and proportion. My recent excavations, carried on at a time when the water stood at a low level, enabled me to study with advantage some of the details of the earliest of the three temples. On the north side, in the foundation pier of one of the inner columns of the peristyle, I found, after minute examination, the remains of the base of a column of the first temple, which was similar to that of the last, and as the cella wall of this Temple was 6 ft. 3 in. thick and the antæ must have had a projection of at least 1½ in., I suppose the columns of this earlier temple were at least 6 ft. 6 in. in diameter. This supposition is justified by the remark of Vitruvius in describing the last temple. He says,—the *improved* Ionic order was employed in this building; that is, the columns were 8½ diameters in height *exclusive* of the base. I have, therefore, computed their height to have been 55 ft. 8¾ in. *with* the base.

The number of these columns (100) is decided by the position of the south anta in the pronaos; the cross wall at the west end, the 11-ft. length of the lowest step of the platform on which this temple was raised, and the remains of the surrounding portico at the east end. Vitruvius describes the Temple as octastyle, and this is fully borne out by the discovered remains.

The position of the Temple at the foot of a hill, which rises at a steep angle, at a short distance from it, is hard to account for; there was ample space, however, to allow of a wide road to pass from north to south, and a large open space in addition; but its position in that part of the plain of Ephesus is only accountable by surmising such a circumstance as the finding of an aërolite or meteoric stone (the image which fell down from Jupiter) which had fallen there, and the man to whom the ground belonged might have taken advantage of his opportunity to get a large sum for it.

The allusion to the image in the town-clerk's speech, Acts xix., gives us strong evidence of an authentic tradition.

It is an extraordinary fact that the site of the Temple was a bad one. It could not be seen from a single house in the city, nor from the Theatre, nor from the Forum. Situated as it was a mile from the city, and at the foot of the hill at Ayasalouk, its remains were silted up and completely hidden from view many centuries before the time of Sultan Selim, who built a large mosque, and a considerable city in that part of the plain.

In the course of a short and hurried discussion which followed the reading of my paper on the Temple of Diana at the Royal Institute of British Architects on the 9th of June, 1884, my friend, Mr. R. P. Pullan, expressed his opinion that the ancient Greeks did not employ sculpture in the tympana of their *Ionic* temples. I am not at present in a position to prove, beyond doubt, that the Temple at Ephesus had sculpture in that position. I found an angle of the west tympanum which was quite plain; but even if there had been sculpture in the tympanum, it might not have extended so far into the angle. Mr. Pullan cited three Ionic temples which he had dug up, and which were without sculpture in the tympana; but these temples might not have been completed, or they might not have been perfect examples of the most highly-finished temples: such a temple as that at Ephesus, without sculpture in the tympana, but so rich in sculpture elsewhere, would have a very unfinished and incomplete appearance. The Ephesian medal of Hadrian, and a medal of Gordianus, exhibit sculpture in the tympanum. The latter is figured in Professor T. L. Donaldson's "Architectura Numismatica." I found at each end of the Temple at Ephesus legs of statues, life size, in high relief, showing just one small attachment in each case. These might have come from the tympana, or from the frieze, on some other part of the Temple. These fragments of sculpture were some of the results of my recent excavations, which yielded altogether about sixty fragments.

Amongst the remains of the earliest Temple found on taking to pieces the massive piers of rubble masonry, which were built, as I presume, by the early Christians of Ephesus as foundations for an intended church, were two most interesting examples: one is a female head with a peculiar coiffeur and ear adornments, which cannot properly be called ear-rings; the face is of a peculiar and barbarous type, with thick lips and broad fleshy nose, the eyes wanting; they had, apparently, been represented by colour. This head was attached to a rounded surface, and it evidently formed part of a sculptured column. The whole was painted. The other fragment is still more interesting. It represents the lower portion of a draped male figure in low relief against a rounded surface; the legs, feet, and close-fitting drapery are so archaic in character that I have no hesitation in saying that this fragment, as well as the female head, must have belonged to a sculptured column of the earliest temple, built by Ctersiphron and his son Metagenes in the sixth century B.C., and to which Crœsus has the credit of contributing so generously. In the same foundation-piers were found some very fine examples of lions' heads from the same temple; also one very fine and nearly perfect example of a lion's head, which had formed a gargoyle or water-spout, from the last temple. The archaic fragments above described justified the demolition of the piers of rubble masonry in which they were found, although upon the piers themselves there was imprinted a most interesting record. They had been built against the cella walls of the temple, which remained at the time up to the height of many feet, and before the mortar was quite dry the walls were taken down: the impression of every stone and the joints of the masonry could be seen perfectly upon the rubble piers. I took care to leave undisturbed sufficient of the angle piers to enable any one who wished to do so to check such parts of my restoration of the Temple as formed part of my data. Small portions of the cella wall on the south side and at the west end remain undisturbed, and these are beautiful examples of the masonry of that period, the sixth century B.C. The general surface of the marble was tooled with a sharp-pointed hammer; a margin of 1¾ in. was drafted round each stone, and the edge was slightly bevelled to preserve the arrises from injury by earthquake. This beautiful walling had evidently served as part of the foundation of the temples which were raised over it.

As very few of the wall-stones remain loose on the spot, it must be presumed that they were all removed after the destruction of the Temple to construct some neighbouring buildings, and some were taken to the city, as I found six of them in the proscenium of the great theatre. This is no mere surmise, for these stones had upon them twenty-six decrees of the Council and the people of Ephesus, conferring the citizenship upon various persons for their services, and the decrees were ordered to be inscribed on the walls of the Temple, where

similar decrees were inscribed. The date of one of these decrees is 299 B.C.

A question particularly interesting to the architect is whether there was an amphitheatre at Ephesus in which it was possible to have encounters between men and wild beasts. The passage in St. Paul's First Epistle to the Corinthians, 15th chapter, wherein he says,—"If, after the manner of men, I fought with beasts at Ephesus," misleads many people, but the "beasts" that St. Paul fought with must have been wicked men. If he had really fought with lions or other wild beasts, he would have mentioned it in writing afterwards to the Corinthians, 11th chapter of the Second Epistle, where he gives a most pathetic enumeration of all the sufferings he had gone through, including even the number of times that he had been beaten with rods. He would certainly not have omitted to include his encounters with wild beasts, if he had ever been so persecuted. There is no record even that St. Paul was imprisoned at Ephesus. The archons of the city, indeed, appear to have befriended him.

I looked carefully for the remains of an amphitheatre at Ephesus, but found no signs of one. There were, indeed, only two amphitheatres in Asia Minor,—at Pergamos and Cyzicus. We may be allowed to suppose that this kind of persecution was not generally practised in Asia Minor.

A curious bas-relief was found in the ground over the site of the Temple, and about 12 ft. from the present surface, having two panels one representing a man armed with a club, with which he has struck the lion on the head on the second day of his encounter; on the third day the lion has won the victory, the man is prostrate, and the lion is tearing out his bowels. The panel representing what took place on the first day is missing, but the man must have been victorious, as on the second day. This bas-relief is an interesting proof that men sometimes survived more than one encounter with wild beasts.

When the excavations were suspended in 1874 the whole of the site of the Temple had been explored, and the surrounding ground for 31 ft. beyond the lowest step of the platform, excepting at the east end on the north side.

The recent excavation has been undertaken for the purpose of exploring the portico surrounding the Temple area, up to which point it is possible some sculptured drums might have been rolled to clear the road around the Temple which was needed for the removal of the wall-stones. It is also hoped that some more of the frieze may be found, as well as enough of the architrave and cornice to complete the order.

Most of the remains of the last Temple which have hitherto been found are now exhibited in the Ephesian Gallery. It may here be repeated that this was the Temple which was built by Dinocrates in the time of Alexander the Great, and which succeeded the Temple built by Pæonius and burned down by Herostratus.

My recent excavations, and further study of the foundations and other portions of this Temple remaining *in situ*, have enabled me to modify my plan in a few particulars.

I now place the Temple complete with its customary three steps upon a platform which is approached by a continuous flight of ten steps. The dimension taken on the lowest step from north to south is 239 ft. 4½ in., the treads of the steps were 22 in., the height 8 in.; the platform was, therefore, 206 ft. 4½ in. wide. The length of the platform cannot be decided from the results of the present excavations, but if it was 425 ft., as recorded by Pliny, there would be ample space for the altars which I have supposed to have existed in front of the Temple at the west end. The pavement of the peristyle was 9 ft. 5½ in. above the pavement at the foot of the steps.

The Temple itself was 163 ft. 9½ in. in width and 342 ft. 6½ in. in length.

The naos or cella was nearly 70 ft. in width and about 110 ft. in length.

Full particulars of the Temple with illustrations are given in the Transactions of the Royal Institute of British Architects for the session 1883-84.

The readers of the *Builder* will be glad to hear that a fund for the further prosecution of the excavations on the site of the Temple is being raised, the hon. treasurer of which is Sir John Lubbock.

## FINANCING ON THE THAMES.

FEW persons, it is probable, are aware that the navigation of the Upper Thames (such as it is), and the degree of attention that is paid to the maintenance of its channel, and to the escape of its flood waters, are mainly provided for by the actual sale of a definite quantity of the water of the river. It is a matter of some importance, both to the riverain residents and to the inhabitants of half London, that it should be known to how great an extent the funds applied to the Conservancy of the river, west of London, are furnished by five of the metropolitan water companies. The fact, however, is undeniable. The authority for the statement will be found in two Parliamentary Returns issued in July last, one of which is a "Return prepared by the Auditor of the Accounts of the Thames Conservancy Board, showing the Income and Expenditure on account of the River from 1777 to 1882," and the other is the "General Report of the Conservators of the River Thames, from 1st January, 1883, to 31st December, 1883."

The powers of the Conservators of the river Thames extend from Yantlet Creek, in the county of Kent, to the City stone above Staines Bridge, and thence to Cricklade, in the county of Wilts. The measured navigable stream, from London to Lechlade, where the Thames and Severn Canal leaves the Thames, is stated by Professor Ansted at 148 miles, and the distance from Lechlade to Cricklade is eleven miles. The first entry of tolls received on this portion of the river on record is the sum of 525*l.* 14s. 2d. for the five months from May to September, 1777. In 1778 the tolls amounted to 1,518*l.*, and they gradually rose to 2,264*l.* in 1810. In 1811-12 a rapid rise coincided with the construction of the Regent's Canal. In 1813 the receipts were 10,445*l.*, and the improvement continued until 1827, when the maximum of 15,924*l.* was attained. The river traffic, as measured by the tolls, remained tolerably steady until 1841, when the effect of railway competition may first be noted. It was not, however, until 1848, in which year the proposal to carry minerals on the London and North-Western Railway at the charge of ½d. per ton per mile was denounced by Mr. Robert Stephenson as a robbery of the railway company, that a very serious decline of the river traffic set in. The tolls in 1848 were 10,951*l.*, or about 500*l.* more than in 1813. At this period the acquisition of the canals by the railway companies, and the obstruction of the inland water traffic, commenced. Five canals were thus acquired in 1845, eleven in 1846, seven in 1847, and three in 1848. The Kennet and Avon Canal was acquired by the Great Western Railway Company in 1852, and the tolls on the Thames fell to 6,403*l.* in the following years. From 1852 to 1871 eighteen more canals were acquired by the railway companies, and the tolls on the Upper Navigation of the Thames reached their minimum of 3,282*l.* in 1873. The effect of the railway policy in abstracting from the rivers and canals of the country a traffic the conduct of which has (some persons maintain) involved a heavy loss to the railway shareholders, while its abstraction has rendered the River Conservators unable to carry out their requisite duties, is thus accurately illustrated by the comparison of the dates above given with the decline in the tolls on the Thames.

Since 1873, in spite of the poverty thus brought on the Conservators of the Thames, the traffic has slightly improved, the receipts standing at 4,135*l.* in 1882. But the cost of maintenance in that year (exclusive of interest on debt) amounted to 17,059*l.* The navigation would thus have become utterly bankrupt but for the contributions of the water companies, aided by the annual payments made by the Grand Junction and the Regent's Canal companies as compensation for loss of tolls.

In 1844 the first payment for water taken from the river, amounting to 50*l.* 19s. 5d., was made by the Grand Junction Water Company. The Lambeth Company commenced a series of annual payments of 200*l.* in 1853; the Southwark and Vauxhall and the West Middlesex companies began to pay 300*l.* a year each in 1854; and the Chelsea Company paid a like sum in 1855; in which year the contribution of the Grand Junction Water Company was also of the same amount. In 1867 the contributions from the water companies rose to 5,000*l.*; in 1871 to 6,000*l.*; and in 1879 to the present figure of 12,050*l.* per annum.

During the past year the water companies, taken together, have derived from 80 to 85 millions of gallons daily from the Thames. The payment above stated is about equivalent to a price of 8s. per million gallons of water. This is equal to about 40 per cent. of the entire cost of the water supply of the city of Chicago; which, again, is almost identical with that of raising the water of the artesian well of Passy into a reservoir, at the height of 53 mètres, at Paris. Thus, while the maintenance of the upper river is now chiefly supported by the contributions of the water companies, it cannot be denied that the payments made by the latter represent a fair equivalent for the quantity of water that they collectively derive from the Thames.

From 1777 to 1834 nearly 5,250*l.* per annum has been spent in improvements of the navigation of the Thames, together with repairs of the locks and towing-path, and wages of the lock-keepers. From 1834 to 1857, the expenditure has risen to upwards of 10,000*l.* per annum, 19,127*l.* having been spent in improvements in the last-named year. From 1857 to 1882, the total expenditure on the Upper Navigation was 266,000*l.*, of which 85,331*l.* is carried to capital account, or, in plain words, represents accumulation of debt. During this period the expenditure which appears to have been actually incurred in the necessary work of maintenance has averaged over 8,800*l.* a year. And out of the total revenue receipts of 185,000*l.*, the contributions of the water companies came to 118,000*l.*

It seems pretty plain that this state of things cannot continue indefinitely. There is small room to wonder why the residents of the Thames Valley suffer so disastrously at one time from flood, and at another from want of water, while the Conservators are thus reduced, by the abstraction of the traffic of the river, to eke out their inefficient funds by the creation of a "capital account." It seems to us to be of no little importance that the public should be made acquainted with the facts above brought together. True, "if it be confessed, it is not redressed"; but confession is a necessary preliminary to redress.

## NOTES.

THE renewal of the notices of an application to Parliament for a tunnel under the Channel points to the resumption of a conflict which it is the interest of all persons concerned as to our public works to avoid. It ought to be insisted on that the town authorities and other bodies who may feel compelled to oppose such a Bill should not be put to that expense unless on the condition of the deposit, by the promoters, of a definite estimate of the traffic which they proposed to carry, of the price at which it was to be conveyed, and of the proportion of the resulting profit to the capital cost of the work. In our early railway times such a statement was indispensable to the passing of the preamble of a Bill. The Channel Tunnel projectors have always eschewed this honest preliminary step, and that, as it seems to us, from a consciousness of their want of a case. In the first place, they have to show that they could convey goods from shore to shore at a cost price in any way approaching the cost of ocean transport. In the second place, they would have to show, on the grounds of the definite knowledge that we

possess of the minimum cost and time which would be required for ventilating the tunnel, what gross tonnage could possibly be passed through it in twenty-four hours, and what per centage the charge for the goods so carried would pay on the cost of the line. These are plain questions, and if they are blinked the public may know what opinion to form.

THE removal of the constriction in the great east and west route near the Mansion House, now about to be carried out, is only an attempt to remedy a crying scandal. The constant increase which each year brings upon the traffic through London may reconcile us to the failure to carry out Sir Christopher Wren's plan of reconstruction after the Great Fire. That a well-ordered network of streets, fully adequate for the wants of the London of 1666, with its noble central waterway, would have been designed by the architect of St. Paul's Cathedral, there can be no doubt. But that the width of the streets would have become inadequate for the centre of a province of 5,000,000 inhabitants is no less obvious, and in the very excellence of the work of Wren we should have found a reason against that demolition which is now being effected piecemeal. It is possible that we shall never be able to render the street accommodation of London what it ought to be. But we can, at all events, avoid constrictions, and refuse to allow two wide streets to be turned into one narrow one.

THE Manchester Chamber of Commerce have had under consideration the proposal of the Bridgewater Canal Directors to deepen the River Irwell and the upper part of the Mersey to a depth of 10 ft., so as to provide improved barge access to Manchester. The Chamber has resolved that no such measure will be acceptable to the large interests which they represent unless it be accompanied by substantial guarantees as to a reduction of rates and charges between Liverpool and Manchester. This resolution of the Board has the more significance from the fact, as stated in the discussion, that the effect of the passing of the Bills deposited by several railway companies for the ensuing session of Parliament will be to raise the present charge of 8s. for conveying a ton of cotton from Liverpool to Manchester to 11s. 2¾d. With such opposite views entertained by carriers on one side, and by customers on the other, a lively time may be expected by those concerned in Parliamentary Committees.

IT appears from a report by the Superintending Architect of the Metropolitan Board of Works that the gross amount of fees received by District Surveyors during the year 1883 was 46,441*l.* 19s. 10d. in respect of 26,479 works, from which it would seem that the average fee is 1*l.* 15s. for every work surveyed. The gross fees show a falling-off in comparison with the amount received in the previous year. The largest sum received as fees by a District Surveyor during the year was 2,443*l.* 8s. 6d., the amount returned by Mr. Andrew Moseley for the district of Fulham. The next largest sum is 1,628*l.* 10s. 6d., the gross amount of fees received by Mr. T. E. Knightley for the district of Hammersmith. The district of West Hackney, of which Mr. George Legg is the district surveyor, and the district of St. Giles's, Camberwell, of which Mr. H. Jarvis is the district surveyor, show an annual income of upwards of 1,500*l.* each. The southern division of Lambeth (Mr. H. Parsons), and the parish of Clapham and the southern division of Battersea (Mr. Edward I'Anson), produced about 1,200*l.* in each case. The smallest amount of fees received was that returned by the district surveyor for the detached portion of Clerkenwell, near Muswell Hill (Mr. R. Parkinson), whose annual income from his district was only 14*l.* 3s. 9d. without deduction for office expenses. The average value of a district appears from this return to be 674*l.*, a sum which, when the usual earnings of surveyors is taken into consideration, must be looked upon as sufficiently remunerative. The oldest district surveyor in point of standing is Mr. Edmund Woodthorpe, who was appointed to the district of St. Anne, Limehouse, St. John, Wapping, the precinct of St. Katherine, and the Hamlet of Ratcliffe, in 1839.

THE Crystal Palace School of Engineering completed its thirty-sixth term on Saturday, when the certificates awarded to the students by the Examiners were presented by Mr. C. Douglas Fox, M.Inst. C.E. Twelve years ago the school opened with nine students; the number has increased continuously, until, in the year and term just completed, 86 students, the highest number ever reached, have been in attendance. At the end of the first year Mr. Douglas Fox, the chairman of to-day, was one of the Examiners. In the first year Mr. Percy W. Britton, A.I.C.E., was a student in the school, and was assigned by the Examiners, the Principal of the School, and by his fellow students, the honourable position of *primus*. Mr. Britton acts at the end of the thirty-sixth term as one of the Examiners of the work of his successors in the school. His colleague in the examination was Mr. Edward Easton, M.I.C.E., M.I.M.E. Both of the Examiners' reports are highly favourable as regards the scope of the instruction given and the methods adopted. Of the Civil Engineering section Mr. Britton says:—"I believe the system followed, as the result of long experience of the best methods, to be unsurpassed in its thoroughness."

PHOTOTYPES of the beautiful bust of Dr. Ernst Curtius, executed in commemoration of his seventieth birthday, and recently completed and presented to him, have just reached English subscribers. The bust is of Carrara marble, by Professor G. Schaper, and admirably reproduces the beautiful but austere features which in real life have much of the set fixity of marble. Each phototype is accompanied by a text containing a short account of the life and work of Dr. Curtius, an account of the proceedings on the festival day, and a list of subscribers. We are glad to see that out of a list of two hundred and fifty-nine, ninety-three are from England and America. In addition to the bust, four offerings in literary form were made,—1. A collection of twenty-seven essays (by pupils and admirers), some of which have been already noticed in the *Builder*. For these essays Dr. Curtius returns special thanks in graceful pentameter verse. 2. An account of his childhood and school-life, printed as manuscript. 3. An important memoir on the Pergamon altar frieze, which we hope to notice shortly. 4. A plate representing a view of the Acropolis and,—very appropriately,—the Altis of Olympia; between them a dedication in Greek. This tribute was offered to Dr. Curtius by a deputation of Greeks resident in Germany, at their head Dr. Herr Rangabè, Greek Minister at Berlin.

A BUST of Mr. Gladstone, executed by Mr. A. Bruce Joy, has just been presented to the corporation of Liverpool by Mr. S. Stitt, and accepted by them. Sir James Picton, speaking for the corporation, characterised the bust as being admirable both in execution and as a likeness.

IT appears that the working men are strongly in favour of the proposed new subway from the Marble Arch to the City. They consider it would provide quick and cheap travelling accommodation between East and West London, which is not now to be had, and for want of which many men are wasting time and strength in walking "nine or ten miles to their daily employment." The "nine or ten miles," we presume, must mean counting going and returning. This is one side of the matter, and an important one. Cheap as the omnibus conveyance seems to the City clerk, it is too expensive for the working man, and consumes a good deal of time too. Mr. Greathead, the engineer for the proposed subway, states that no disturbance of the roadway would be occasioned in making it, except at a few points where the stations would ultimately be placed. But we imagine the disturbance at those "points" would be very considerable, and not at all restricted within the mathematical definition of a point. Still, the working-men's interest, if correctly represented, is very important, and should have every consideration.

THE Canadian Pacific Railway is the great Canadian road from the Atlantic to the Pacific, and will become the shortest route from England to China and Japan. From Montreal to Vancouver, the east and west posts, is a stretch of rail of about 2,900 miles, passing over the Rocky Mountains at an altitude of 5,300 ft. above the sea, through the grandest mountain scenery, over boundless prairies, and opening up the finest wheat-growing and grazing countries in the world. The rail route is not yet complete, and traffic during the open season is carried across the lakes from Owen Sound to Port Arthur on the north-western side of Lake Superior. The stations along the line are at present of the simplest and rudest class of building, the country being but sparsely settled or reclaimed from its primeval wildness. Eagle River station is about midway between Port Arthur and Winnipeg, picturesquely situated amongst the hills.

ON the 31st of December the *Times* devoted ten columns and more to a review of the principal events of the passing year, ranging from questions of domestic and foreign policy of the highest interest to the deaths of the ballet-dancers Taglioni and Fanny Elssler. The Garmoyle breach-of-promise case and the Adams-Coleridge libel-case were thought worthy of a place in the long record, in which even the ex-convict Orton is not forgotten. But from first to last there is not a word about art. Such trifling matters as the decision of the judges in the Government Offices competition, the re-building of the tower of Peterborough Cathedral, and the restoration of Westminster Hall, were, it is presumed, too insignificant for notice. Strange fatuity, which thus ignores works which will for good or evil endure ages after the political and social squabbles of the day shall have been buried in oblivion!

YESTERDAY (Friday, January 2nd) was the anniversary of the foundation of the Institution of Civil Engineers, which was established on the 2nd of January, 1818. From a new list of members just printed, it appears that there are now on the books 20 Honorary Members, 1,447 Members, 1,889 Associate-Members, 508 Associates, and 804 Students,—together 4,668, against a total at the same date last year of 4,443.

THE exhibition of the Gainsborough Collection at the Grosvenor Gallery is of exceptional interest, and an admirable pendant to the previous exhibition of the works of Reynolds in the same Gallery. We will notice it in detail next week.

A BILL is to be applied for in Parliament next session by the local authorities of Kingston for the dissolution of the Lower Thames Valley Main Sewerage Board, and for the provision for the formation of separate Boards, to be called respectively the Richmond District Main Sewerage Board, the Kingston-upon-Thames Main Sewerage Board, and the Molesey, Hampton, &c., Main Sewerage Board. The stated object is to convey the sewage to some convenient place where it may be purified by application to land or by chemical treatment, and rendered fit for discharge into any stream or watercourse beyond the action of the Rivers Pollution Act or of the Thames Conservancy Acts. Apparently this points to the adoption of the same principles as were recommended in the Report of the Royal Commission on Sewage,—the chemical treatment of the solids and the reduction of the liquids to a comparatively innoxious effluent.

IN reference to this said sewage subject, Sir John Lawes startles us by a long letter in the *Times* of the 29th ult., urging that the most remunerative way of disposing of the

sewage of London is by pouring it into the river or into the sea, which will do as well. "It largely increases the production of fish, provided it is sufficiently diluted, and does not interfere with their health." It supplies a large proportion of the chemical ingredients,—nitrogen, phosphoric acid, and potash,—which are carried away by the fish, and which, in fact, form part of their composition. If this can be established, it is a delightfully easy solution of the problem. Only let us have it carried further out to sea to feed the fishes, and not make the larder under our very noses, as it were. "A long shot, Sir John, if you love us!"

## THE TOWER AT THE CLOSE OF THE SIXTEENTH CENTURY.

A SHORT time back we gave a description of the ancient residences of our monarchs at Westminster, and we now propose to say a few words respecting their chief city residence "The Tower." Our intention is simply to convey to our readers some notion of its appearance towards the close of the sixteenth century,* and not in any way to deal with its history, a subject so voluminous and so full of interest that to write it would be little short of undertaking a history of England.

Although "The Tower" still preserves a good deal of its Mediæval arrangements, and in this respect differs widely from the "Old Palace of Westminster," yet it must not be supposed that it has not suffered very numerous and regrettable alterations and degradations during the past three centuries. In one respect its aspect and plan are greatly changed, and that in a most important feature. We allude to the entire and complete destruction of the noble "palace" which stood within its walls: not one trace of this building now exists! The "White Tower," or Norman keep of Gundulf, still rears its lofty walls in the midst of the fortress; the outer ballium, with its bastions and towers, is still tolerably perfect; the inner ballium is, for the most part, entire; the old Chapel of St. Peter ad Vincula, the house of the Lieutenant, the "Bloody Tower," of fearful notoriety, the Beauchamp Tower, carved with the memorials of many an ill-fated prisoner, are still to be seen; but what has become of the palace of our kings? Alas! not one stone of it remains.

By a kind of poetical justice the inscriptions, mottoes, and names of the victims of tyranny and oppression, carved by their own hands, are everywhere to be seen and read, but the noble palace of those who were too often the oppressors has so thoroughly disappeared that, were it not for ancient documents and drawings, its very existence might be a matter of doubt! It is a most singular fact that the Mediæval palaces of our kings in and near the metropolis have almost entirely disappeared. Of the ancient palace of Westminster the Hall alone remains; of the Bridewell not one stone exists; of the two "Nonsuches" not a vestige; of Baynard's Castle nothing whatever; of Kennington even the site is doubtful; of Richmond a single gateway; of Whitehall the doubtful foundations of a wall; of Greenwich nothing whatever; of the Savoy the Chapel; and of St. James's the gateway, possibly the chapel, and portions of the court-yard. The only Mediæval palace which remains in anything like a state of entirety is Hampton Court, and that does exist as a monument of shame and infamy, a terrible sermon upon the text, "Put not your trust in princes!"

The Tower differed from all the other palaces in the fact that it was at once a citadel, a fortress, and a palace. Probably, as originally erected, the Keep, or White Tower, was used as the residence of royalty, though, looking at its great plainness, almost rudeness of construction and detail, it is difficult to believe that it could have been intended for a royal residence except during times of war or civil commotion, and there seems to have been a separate palace, erected at a very early period, probably even as early as the time of William Rufus. The buildings were, however, re-erected and greatly added to by that "Builder-King" Henry III., and, however we may disapprove of that monarch's political acts, it is but just to acknowledge that he was a most munificent patron of the arts, especially architecture. Apart from the "White Tower," most incorrectly called "Cæsar's Tower," the larger portion of the Tower of London dates from his reign.

Of the original buildings of the Tower, Gundulf's Keep, called the "White Tower," is the only important edifice now existing. It is an interesting rather than a fine example of Early Norman work, but vastly inferior both in design and construction to many of our Norman castles. It is singularly plain and devoid of ornament. The chapel alone possesses anything in the way of architectural detail; four of the original windows exist; they are almost rude in their simplicity and bear little resemblance to the windows lately executed by way of restoration.

The great palace of the Tower was situated to the south and east of the White Tower, it was bounded to the west by the wall leading from the "Garden Tower," now called the "Bloody Tower," at the north end of which, close to the White Tower, was a gate called "Cold Harbour," which gave admittance to the court of the palace, immediately in front of the White Tower; facing south was the jewel-house; on the opposite side of the courtyard was the Great Hall, erected by Henry III.; to the east was a series of buildings called the Queen's Lodgings, in which was a gate passing to the second court, or Privy Court of the Palace. This court formed an irregular square with a tower at each angle. Those on the north side were called the Wardrobe Tower and the Broad-arrow Tower (the latter still exists); between these was a range of buildings called "The Wardrobe." The wall of the inner ballium connected the "Broad-arrow Tower" with the "Salt Tower." Probably there was a gallery or row of buildings within the wall. The Salt Tower is the only existing tower which may possibly be regarded as a portion of the old palace, though it does not appear to have contained any of the apartments of the royal residence. In documents of the reign of Henry VIII. the Salt Tower is called "Julyus Sesar Towr." The curtain wall of the inner ballium did not return to the south parallel to the outer ballium, but was carried straight on to the "Well Tower," where it joined the outer ballium (that is to say, if ancient plans and representations are correct). A building, called the "Queen's Gallery," which appears to have been partly of wood, or post-and-pan work, went in an oblique direction from the Salt Tower to the "Lanthorn Tower," and another building, called the "King's Gallery," extended from the Lanthorn Tower to the outer ballium, which, with the walls and buildings previously mentioned, enclosed an irregular court planted as a garden, and called the "Privy Garden." In order to make up for the absence of the inner ballium or wall, in this part of the palace, the outer ballium was defended by two extra towers, the "Cradle Tower and another "tower adjoining the King's Privy Closet." It is singular that no name is given to this tower in the survey of the 23rd of Henry VIII.

There seems to be evidence that some of the buildings composing the palace were partly of wood, because in the survey for repairs made in the 23rd Henry VIII., before alluded to, we find the following items mentioned:—"A great carral window of *wood* in the Queen's dining-chamber,"—wooden buildings existed in other parts of the Tower,—for instance, the seven houses of office which stood near the Bloody Tower, until about a quarter of a century back, and were very interesting examples of timber-work. There is also an account for "a battlement of timber on the west side of 'the Wardyn Gate.'" This is undoubtedly the old timber and post-and-pan work existing on the east side of the Byward Gate, which is proved from this to date from the reign of Henry VIII., and deserves to be preserved, as one of the only examples of the kind left at the Tower. These wooden erections were by no means uncommon in ancient castles. The beautiful Horse-shoe Cloister at Windsor is a charming example, and we cannot be too grateful to the late Sir Gilbert Scott for the care with which he preserved and restored this interesting feature of Windsor Castle.

It is not our object to describe the various alterations which have from time to time taken place at the Tower. Every one is willing to acknowledge that the earlier attempts at "restoration" were dismal failures, and did much to rob the noble old fortress of its genuineness and its historical interest. Two of these works are particularly regrettable,—they are the removal of the picturesque old gabled buildings, called "the Seven houses of office," which stood between the White Tower and the Bloody Tower, erected, as is proved, by the survey of 23rd of Henry VIII., at that date, and thus being amongst the earliest examples of Domestic work in London. Their site is now occupied by a kind of open arcade of the most dismal design,—a sad exchange for the quaint old gables, pretty bow-windows, tiled roof, and red-brick chimneys, which formed such a favourite subject for artists thirty years ago. Another work which we deeply regret is the re-working of the entire surface of the interesting old Chapel of St. John in the White Tower. This chapel was probably the most perfect example of an early Norman building in England, but it had been disfigured by being filled with cases for the records which were kept here, and its walls were covered with whitewash. Now it was undoubtedly right to remove the shelves and other modern obstructions, and the whitewash might very properly have been removed, but, when this was done, the greatest possible care should have been taken not to destroy the ancient surface beneath it, because we have distinct documentary evidence that Henry III. decorated this chapel with colour, and vestiges of that scheme of colouring were absolutely to be traced, and were seen by the writer of this article in the years 1848, 1849, and 1850. That no trace of ancient decoration now exists is not to be wondered at, as the ancient surface of the walls and columns has been *scraped away and renewed!* nor is this the only case in which ancient decoration has been obliterated at the Tower, for in the embrasure of the easternmost window of the Wakefield Tower which evidently served as an oratory, before the altar of which Henry VI. is traditionally asserted to have been kneeling when he was murdered, the traces of two figures were visible before the restoration. The whole restoration of this apartment, now used as a jewel-chamber, is to be regretted, as there can be little doubt that the east window which lighted the oratory was a large one, and the others were mere slits, but, as now restored, all the windows are the same size. It should be noticed that the arrangement of this prison in the Wakefield Tower, with the chapel or oratory formed in the embrasure of the easternmost window, is identical with that of the crypt of the Chapter-house of Westminster Abbey, with the exception that at Westminster there is a central column.

Although the latter restorations are probably more in accordance with ancient precedent than the earlier ones, yet we cannot help asking the question why restore the Tower at all? Why not leave it to tell its own story in its own way, with all its imperfections, incongruities, and patchings up, but with each portion genuine, and not made to look supernaturally Mediæval. If we want to see Mediæval castles we can see them elsewhere, but it is a mistake to carry out conjectural ideas of Mediæval castellated architecture at the expense of a building so historically interesting as the Tower.

We may, of course, be told that "some kind of restoration is necessary in order to render the building *practically useful*." In other words, to make it serve as a barrack or a store for arms. But why attempt to find such *uses* for the venerable structure? To our minds, it has a far higher and far nobler *use*. We are yearly spending millions upon "educating the masses." Now, we would ask, does the Tower teach nothing? Do not its grim walls contain veritable "sermons in stones"? Sermons which preach to us the shortsightedness of human tyranny, and the dignity and nobility of patient suffering for conscience sake? Upon the walls of the Beauchamp Tower is still to be deciphered, the bold signature of Philip Howard (Earl of Arundell), a victim either to the jealousy of Elizabeth or the suspicious tyranny of her ministers; below that signature, and written in another hand, are the words, "*Gloria et honore coronasti eum.*" The palace of the Tower has passed away and is forgotten. The dynasty which put this man to death has ceased to exist, and is chiefly recollected for its cruelty and tyranny; yet this epitaph, though *only scratched with a nail*, remains more touching in its dignity and simplicity than any in Westminster Abbey!

* See illustration in the present number.

We who enjoy the blessings of liberty of conscience and freedom are, in our ease and luxury, too apt to forget at what a high price those blessings have been bought for us. In putting away from us the thoughts of ancient tyranny and cruelty, we are too apt to overlook the heroism and fortitude with which they were met. The patience under affliction, the long imprisonment, bravely borne, the endurance of torture, nay, even of death, rather than the abandonment of the truth, are lessons taught by many an inscription, device, or monogram in the Tower; and we would ask whether any school can teach nobler lessons, and whether, therefore, the Tower does not deserve to be preserved as a great public teacher and a preacher of the noblest morality? Surely our countrymen must begin to feel that there are things above mere commercial requirements; that public buildings and monuments may be useful and valuable, although you cannot "turn a penny" out of them, or convert them to suit the practical requirements of the age.

H. W. B.

## THE IRON TRADE IN 1884.

IN reviewing, in these columns, the state of the English iron trade during 1883 at the beginning of last year, the hope was expressed that the new year might not prove worse than its predecessor. It must now be acknowledged that that feeling was doomed to disappointment, for 1884 will take its place as one of the worst years through which the iron trade of Great Britain has yet passed. In 1883 there was still, if not abundance, at least sufficiency, of work; during the past year the falling-off in exports, to which we shall presently refer, not merely reduced the values of every description of iron and steel to a great extent, but it also seriously curtailed employment, and thus brought with it dead loss to the manufacturer and want to his workman. Shipbuilding especially presents a sorry chapter in the industrial history of 1884, the returns from the chief building centres showing a very large reduction in the tonnage produced. It is estimated that the total output of ships, including ports producing small tonnages, has been about 500,000 tons less in 1884 than in the preceding year. This unexampled depression in trade has proved a general calamity to thousands of willing hands and their families, who have been made to feel the pinch of hard times; whilst the restricted inquiry for ship-building material has reduced prices to their lowest level. The failure of the demand from America and the competition of foreigners in markets hitherto considered our own also helped to render the state of the British metallurgical industry still more critical. As in 1883, railway construction in the United States has been comparatively restricted, whilst the producing capacity of American works has grown steadily. As a result, our iron and steel exports to the States in the eleven months ending November 30th last show a total falling-off of 222,000 tons. In this total the decline in exports of hardware and cutlery, as well as of machinery, are not included. In value the total decrease in the eleven months of our iron and steel exports to the United States was 1,662,207*l*. But while the past year has been one of unexampled severity for all engaged in the iron trade, there is every appearance that the worst time has passed, and there exist some grounds for hoping that the year upon which we have just entered will see an amelioration.

The Board of Trade Returns for the first eleven months of the past year show that we exported of pig-iron 262,531 tons less than in the corresponding period of 1883, and it may be safely predicted that the total exports of crude iron for the whole year will fall short by about 300,000 tons. The total deficit in our iron and steel exports for the eleven months ending November 30, 1884, as compared with the previous year, amounts to 497,702 tons. A decline in the exports means decreased production, and, to some extent, increased stocks. The total estimated production of Scotch pig-iron during the year was 998,000 tons, a falling-off of 141,000 tons as compared with 1883, and of 188,000 tons if a comparison be made with the most productive year, 1881. The output of Cleveland pig is about 830,000 tons less than in 1883, having been in 1884, in round numbers, 1,930,000 tons, against 2,760,740 tons in the preceding year. The production of crude iron in other districts has been reduced to a similar extent. The stocks of pig-iron at the end of 1884 were very considerable, and would probably have been the largest ever known if a reduction in the make had not been resolved upon early in the year. There were, in Connal stores, on December 25, 1884, of Scotch pig-iron, 821,000 tons, as against 835,000 tons at the same date in 1883, while the stocks of Cleveland pig have increased some 50,000 tons, notwithstanding the reduced make. The total shipments of Cleveland pig-iron for the year 1884 amounted to 927,496 tons, against 992,815 tons in 1883; of Scotch pig, they were 534,000 tons, against 647,000 tons in 1883.

If we now turn to the subject of prices obtained in 1884 for the various descriptions of iron, we find that the decline in value has been general. And it may be observed here that, although prices dropped much more in 1883 than in 1884, the depreciation in the former year was felt not nearly so much as in the latter, because that year was, on the whole, a better one. Rates had not then reached their bottom, and as there was a comparative abundance of work, manufacturers had not to face the collapse of consumption which was only too palpable last year. It did not matter what reduction they were willing to submit to in the matter of prices, even the most extensive concessions on their part would not have brought them orders, for there was no demand for their products. In the beginning of 1884, on the shutting down of eighteen blast-furnaces in Cleveland, as agreed on by the makers, prices of Cleveland pig went up about 1s. 6d., whilst Scotch pig rose about 9d. per ton. Cleveland No. 3 thus began the year at 37s. f.o.b., and the fluctuations have since then been very trifling; but, notwithstanding the restriction of make and the resistance of producers to reductions,—a resistance which only gave way in the last quarter of the year, as far as price was concerned,—the general tendency of trade has brought the value of Cleveland pig down to about 36s. Scotch pig iron,—that is to say, warrants,—opened at 43s. 9d. in January; from that month the price began slowly to recede, until in June it had reached 41s., when it again took a turn upwards, and, under the effect of speculative influences, reached 44s. 4d. in November; but at the end of the year it had settled down again to 42s. 3d. cash per ton. Amongst finished products, shipbuilding iron, from causes only too well known, has lost most heavily; but it should be pointed out that the growing use of steel instead of iron for ships has also had a lowering effect on ship material. The depreciation that has taken place will be best understood when it is stated that, whilst in December, 1883, the net average price in the North of England of bars, plates, angles, and rails (iron), was 5*l*. 7s. 11d. per ton, at the end of October, 1884, it had gone down to 5*l*. 1s. 8½d. The price of common bars in Scotland has declined from 5*l*. 12s. 6d. to 5*l*. The price of marked bars in the Black Country was 7*l*. 10s. in the beginning of the year; at its close, they are nominally the same, but it is a fact well known to the trade that good orders may now be secured at from 10s. to 20s. less per ton. The prices of plates, girders, and bars in Staffordshire have been much affected throughout the year by the competition of ironmasters from the North of England and South Wales, who have imported them at 20s. below native rates. In Lancashire the absence of activity has forced down the price of bars about 10s. per ton below what they were quoted at the beginning of 1884. Bars fetching in January last 6*l*. to 6*l*. 2s. 6d. may now be had at 5*l*. 10s. to 5*l*. 11s. 3d.

There was one satisfactory feature with regard to the English iron trade in 1884 which should not be overlooked. The rail makers of Great Britain, seeing the profound dulness in the rail trade, agreed early in the year to maintain prices and restrict production. This agreement, together with the establishment of the international syndicate of the rail manufacturers of England, Belgium, and Germany, having a similar aim, has had the effect of raising the price of steel rails from 4*l*. 5s. to 4*l*. 15s. per ton in this country, from 120 fr. to 130 fr. in Belgium, whilst in Germany they have maintained their value. The firmness in the rail market has had a beneficial effect on other steel products; but, on the whole, if we except compound armour-plates, and one or two of the industries turning out light steel manufactures, the business done has been unremunerative. There is very little to add concerning the related branches of the iron trade. Shipbuilding has been, as we know, as bad as it could well have been. Engineers, if they have not done quite so well as in 1883, have at least had their fair share of work. The tinplate trade, on the whole, has been satisfactory, if not prosperous. Fair prices were realised during the first half of 1884, but the declining demand from the United States latterly has depressed rates very much. The hardware industry, owing to keen competition and underselling, has had a bad year, and prices have ruled which must have entailed loss on the manufacturer. But it is now generally conceded that the new year will be a better one for this branch of trade than its predecessor. There have been a few trifling wages disputes in the iron trade, the men having had to submit to the inevitable.

Briefly stated, although the year as a whole has been one of the worst known for some time, the condition of the English iron trade at its close is not much worse than at its beginning. There has been a serious falling off in exports, and home consumers have been buying only to meet pressing requirements. But when it is considered that the year began with a heavy weight of stocks on hand, and that there has been an unexampled depression in ship-building, the wonder is that the year just closed has not been of a more calamitous nature. There is really no room for despair; the stability of most of our great iron manufacturing firms proves that, if they have not been able to do a flourishing trade, they have secured at least a sound business. They have weathered the storm, and it is this fact which causes us to look with renewed hope to the future.

A few words respecting the condition of the iron trade of the Continent during the past year will not be out of place here. Notwithstanding prohibitive tariffs and protective syndicates, continental iron manufacturers have suffered quite as much as our own. Whether we look to the most "protected" countries,—Austria, France, and Germany,—or to a country where import duties on iron and steel are of the slightest nature, such as Belgium, there has been a general reduction of values. As hitherto, the iron market of this country still asserts its old influence over those of the Continent, although the metallurgical industries of foreign countries have developed immensely during the last twenty years. In Austria, the good times of previous years have been followed by a period of depression, due to various causes, chief amongst which are the gradual emancipation, industrially, of Hungary from the Cisleithan portion of the Austrian Empire, a diminution in railway construction, the inability of agriculturists to sell their harvest, and the crisis in the sugar trade. But there are various signs that the Austrian iron trade will soon recover its previous activity. The iron manufacturers of Belgium have had a bad year, one of the worst of recent times; the principal hardship with them being not so much an absence of demand, but the large reduction in the value of all descriptions of iron, excepting steel rails, which, from causes already pointed out, have gained. In France the downward course of prices which was a characteristic feature of 1883 has not been arrested in 1884, and iron and steel are now cheaper than ever they have been before in that country. To quote one example. Steel rails, which were sold at the end of 1883 at 170 fr. at works, have recently been disposed of at 120 fr., which is a reduction in price of nearly 30 per cent. German producers have, perhaps, fared best of all. The output of iron and steel, as far as can be ascertained, has not fallen below that of 1883. The decline of the value of products has also not been what could be called ruinous, between 2 and 5 marks per ton, over-production and consequent competition being chiefly responsible for the reduction in value.

**Buildings for Poor-Law Administration.**—The Guardians of the Poor of the parish of Lambeth have instructed their architect, Mr. T. W. Aldwinckle, to prepare plans for the extension of the laundry and receiving-wards at the new workhouse, Brook-street, Kennington-road.——The Guardians of St. George-in-the-East had before them, at their last meeting, plans prepared by their architects, Messrs. Wilson, Son, & Aldwinckle, for the extension of the workhouse and infirmary, at an estimated cost of 9,500*l*. The plans were adopted and ordered to be forwarded to the Local Government Board for approval.

## FROM PARIS.

THE year 1884 has closed rather gloomily in Paris, and the terrors of an epidemic, which remained otherwise extremely mild in character, dealt a fatal blow at Parisian industry, usually so active during the last quarter. Art is affected by the general dulness. The theatres exhibit an alarming decrease in their receipts; public sales, no longer having for their object the famous Basilewski collection, which Russia has carried off from us by the expenditure of millions, are reduced almost to none; private building, but lately so active, has nearly everywhere ceased; in short, all manufacturers, merchants, sculptors, painters, and architects complain bitterly of the uneasiness produced by this unusual stagnation.

It is, then, to be desired that a little vitality should be given to trade by some large enterprise, and for this reason it is much wished here that the sanction of the State should be promptly given to an important undertaking which the Company of the Western Railway proposes to execute with the financial concurrence of the Parisian Municipality. We allude to the opening out and enlarging of the St. Lazard Station, well known to all travellers entering France *viâ* Folkestone and Boulogne, and convenient, from its central situation, to both foreign visitors and Parisians. We propose to give later on a drawing of the new buildings, but will confine ourselves at present to saying that an expense of twenty millions will be involved, that the aspect of a rich and populous quarter will be much modified, and a large workshop be open for some years to artisans now without employment.

It is certainly not for the sake of restoring a commercial value to art that a certain number of artists, calling themselves "Independents," have just opened an exhibition of their works in the Champs Élysées; a collection of pictures void of talent or originality, which cannot even pretend to rank with that of the "Impressionists." The "Independents" are nearly all from amongst what may be called the dried-up fruits of painting, excluded for ever from the official *salons*. On the other hand, the curious exhibition of "Sport in Art," open in the splendid Petit Gallery, Rue de Sèze, has been warmly received by the public. It contains, besides works by Carle Vernet, Géricault, and Oudry, pictures by our most celebrated modern masters (Gérôme, Lewis Brown, Jadin, &c.). No other exhibitions are mentioned. The State and the city are arranging for the reception in a building still to be constructed in the Place d'Jena, of the Oriental Museum, generously offered to Paris by M. Guimets, a rich collector, of Lyons. The Government is also occupied in elaborating the plan for the International Exhibition of 1889, of which the site seems to be definitely fixed. It will occupy the Champs de Mars, the Trocadéro, the Invalides, and all that part of the river between the bridges of Jena and the Invalides. We shall often have occasion to return to this subject, connected as it is with international commerce.

As usual, the municipal administration here is giving the impulse to artistic works. It is actively engaged on the new buildings for the School of Medicine, and preparations are being made to lay the foundation-stone of the Sorbonne, of which, later on, we shall furnish a complete view. At the same time, the old orangery of the Luxembourg Gardens is being enlarged and altered to contain the museum of living artists, which the exigencies of parliamentary life have displaced from the ancient palace of the Medici.

On the other hand, the interior of the Hôtel de Ville is nearly completed, and the reception-rooms will soon be put into the hands of decorators and historical painters In the square of the Hôtel de Ville (to be opened to the public in a few days) a pedestal is being constructed for the statue of Étienne Marcel, executed by M. Jdrac, after a competition. On the quay, not far from the Institute, Conti is also raising a statue of Voltaire on a beautiful pedestal, designed by M. Formigé, a young architect of great talent.

When we have called attention in this rapid review to the restoration of the admirable window glass of St. Etienne du Mont, the incomparable work of our painters on glass of the fifteenth and sixteenth centuries; when we have mentioned the beautiful decoration of the Salle des Maréchaux just finished, by M. Thirion, at the Ministry for War; and when, lastly, we have announced that M. Dièts, architect of the Hôtel Dieu, has been elected member of the Academy of Fine Art, and that M. Daumet, to whom we owe the splendid Château of Chantilly, has been chosen to continue the works at the Church of the Sacré Cœur at Montmartre, begun by the late M. Abadie, we shall have pointed out the chief events of the month just ended.

We cannot conclude without mentioning the irreparable loss which French art has just sustained in the person of Bastien Lepage, dead in the full force of his youth and talent. This artist, so justly appreciated in London, took a marked place here in the new school of painting, which, leaving on one side the traditions of the Roman school, devotes itself earnestly to the reproduction of nature in her simplest and truest forms.

Bastien Lepage was only thirty-nine, and his short life was entirely devoted to art, which contained for him the sum of joy and ambition.

## A NOTABLE OLD MANSION.

### CALLENDAR HOUSE, STIRLINGSHIRE.

SCATTERED over the face of the country, ancient castles and Mediæval family mansions in ruins are well-nigh as plentiful as modern county seats of all grades are, and certainly more plentiful than those distinctly occupying the first and second ranks; but of specimens well mellowed with age, yet still enjoying a condition of habitable usefulness, there are comparatively few to be encountered. Of strongholds of a really remote date handed down to the nineteenth century through an unbroken succession of living and life-like occupancies, there are fewer still. A remarkable and now comparatively little noted specimen of the latter exceedingly rare class is to be found in Callendar House, Stirlingshire, the ancient seat of the noble family of the Livingstones, attainted after the abortive rising of 1715, and now in possession (mansion-house and estates as well) of the Forbes family. Callendar House, or Callendar Castle as it was formerly called, stands almost on the brink of the renowned Roman barrier constructed from eastern to western seas A.D. 140 by the Emperor Antoninus Pius. Its spacious park marches with the great north road and the main Edinburgh and Glasgow turnpike, which are here one; and the entire messuage is in the immediate neighbourhood of the municipal burgh of Falkirk, the chief intermediate seat of population between these two cities. Tradition indirectly assigns an exceptionally remote age to the first occupancy of the site as the central rallying-point of a great territorial domain. According to this rather shadowy authority, Kalynter Castle, under some other name perhaps, was a place of strength at the time the Picts found themselves thrust out of that part of the country, and it is left to be inferred that it had been so a long time before that epoch, since there is no traditional or other mention of any kind respecting the first setting up of this ancient fortress, which afterwards received the name of Kalynter or Callendar and has retained it down through the centuries to our own day. Something slightly less intangible than tradition has it that Kalynter was held by the Romans as the villa or place of residence for certain successive officers of the army of invasion and occupation. The house stands now, as always, on the line of the military road which accompanied the barrier at a distance of a few hundred yards more or less to the southward, and it is, therefore, safe to assume that while the occupation lasted it could hardly be in other possession than that of the Romans. The invaders were forced to finally abandon the Forth and Clyde line towards the close of the fifth century, and from that time, for some centuries, there is no mention of Kalynter, or of its fortunes while passing through this the most obscure portion of the Scottish annals. Towards the dawning of Mediæval or modern authentic history, Callendar emerges as the seat of a powerful thanedom, the only instance of the kind ever existing to the south of the Forth. How long this Thanedom of Calentyr flourished prior to the first historical mention of it must be matter of conjecture merely. The Calentyr family of that ilk is on register as in possession of title and property at the beginning of the thirteenth century, with the reputation of an establishment so firm that it may well have dated several centuries to the back of that, if not actually to a period following shortly on the Roman evacuation. The family stronghold then stood on the same site as that occupied by the Callendar House of our day, and as the structural record of the building has consisted from the earliest traditional and historical times of repairs, enlargements, and alterations only, and never of anything of the nature of a renewal complete, it is altogether probable that some masonry remnant of the original erection of stone succeeding the log fortress of the remote era of the great Caledonian forest, yet lingers within the casing of the existing edifice. It is this feature which is one of the chief attractions of Callendar House for a certain order of mind. The family found in possession in the dawning light of the earlier part of the thirteenth century was that of the Calentyrs, Kalynters, Callenters, or Callendars, regarding whom it is an open question whether they gave their name to the castle and property, or took it therefrom after consolidating proprietary rights. The Thane first mentioned is Malcolm, to whom succeeded his son, Alwin, and afterwards his grandson Patrick. The latter, espousing the fated cause of Baliol, in the succession wars, was eventually deprived of title and estates by the victorious Bruce, who bestowed them upon Sir Wm. Livingstone, a scion of the Livingstone family of West Lothian, and a tried henchman of his own. This founder of the noble Livingstone family had the craft to secure in marriage Christiane de Calentyr the only child of the forfeited Patrick, and so confirmed his new possession by right of ancient succession, as well as by royal charter. The castle which thus, along with a vast though comparatively worthless acreage there, fell to Bruce's follower, was a strong fortress, as strength was at that time estimated. The "keep" was a heavy square structure of considerable elevation and immediately protected by a projecting outwork of massive proportions. A deep moat surrounded these, while beyond, at the distance of two or three hundred yards and enclosing some garden and orchard ground, rose a strongly-fortified wall of stone and lime, called the Barbican and quite encircling the fortress proper, access being obtained by one gate only, pointing to the north and jealously strengthened. In this form, affected only by the casual repairs rendered necessary from time to time, the castle of Callendar existed for about four centuries thereafter.

The Livingstones of Callendar gradually grew in power and fame until they vied with the Douglasses themselves for the position of premier family of Scotland. Sir Alexander, early in the fifteenth century, figures as regent of the kingdom and custodian of the person of the infant king James II. Sir James, in 1453, was sworn Privy Councillor, and appointed Master of the Royal Household and Great Chamberlain of Scotland, preferments which in that rude age and unsettled country not unusually fell to him who was powerful enough to command them. He was afterwards raised to the peerage under the title of Lord Livingstone, and finally closed his career by the side of his royal master on the fatal field of Flodden. Alexander Lord Livingstone, his son, was coguardian with Lord Erskine of the infant Queen Mary, with full charge of her education. It was he who thwarted the designs of Henry VIII. with regard to the betrothal of the child princess to the English heir, the deed binding the Scottish confederates to an opposition *à outrance* having been signed at Callendar Castle itself. Lord Alexander accompanied the child queen when she went to France upon her thirteen years of sojourn there, and it is worth mentioning that his youngest daughter, Lady Mary Livingstone of Callendar, was one of the celebrated four Maries chosen when infants to grow to womanhood in the constant companionship of their royal playmate. Lord Alexander died in France, and to him succeeded his eldest son William, brother to the Mary mentioned. On the return of the widowed queen there ensued frequent royal visits to Callendar Castle, the scene of part of her stay during childhood and the home of her fast friends the Livingstones. She dined there August 12th, 1562, while upon one of her northern progresses and some time before the name of Darnley had been mentioned as a likely king-consort. She was present again in the following year at the christening of an heir to the noble house of Callendar, and only three weeks after her marriage with Darnley the pair

tarried at Callendar over night in passing from Glasgow to Stirling. In December, 1566, the queen, by that time in open rupture with Darnley, touched at Callendar on her way to the christening of the infant James at Stirling, and four weeks subsequently she and her newly-christened child, the future James VI. of Scotland and I. of England, slept one night there. Only ten days subsequently the queen with retinue once again sought the hospitality of her Callendar friends while speeding to the side of her graceless husband, then stricken with small-pox at Glasgow; within a week thereafter returning that way, *en route* for Edinburgh, with the recovering but now sorely-disfigured patient in a travelling litter, on which occasion a night's halt was called at the same always welcome and welcoming refuge. Less than a fortnight subsequently the poor king-consort met his still mysterious fate at Kirk-of-Field, Edinburgh. Six weeks afterwards Queen Mary while on her way from Stirling to Holyrood visited for the last time the familiar battlements of Callendar. She halted but an hour or so, and her small cavalcade had spurred eastwards little more than another hour, when, at Linlithgow, Bothwell with 1,000 men at arms at his back swooped down upon his prey, and carried Mary off to a fatal, though only temporary, captivity.

The Lord of Callendar remained a staunch Queen's man in the troubles that ensued; fought at Langside, and accompanied his unhappy mistress on her flight into England. Being afterwards joined by his wife in this voluntary exile, the faithful pair shared the captivity of their mistress up to the very eve of Fotheringay, returning to Callendar only at last to die. Lord Alexander, the son and heir of these, inherited the well-earned confidence of the Stuart family, and when children came of the marriage of young King James with Princess Anne of Denmark, he and Lady Livingstone were solicited to undertake, within their own household, the tutelage and upbringing of the elder born. Under this arrangement the Princess Elizabeth spent her infancy and youth within the family circle of the Livingstones at Callendar Castle, along with a younger sister, who, however, appears to have died early. This Princess Elizabeth afterwards became by foreign marriage Electress Palatine and Queen of Bohemia, and it is through her the present reigning dynasty of Great Britain and Ireland makes good its title to the throne. For these offices and general faithful service and adherence, James raised the house to the dignity of an earldom under the title of Linlithgow, to be shortly followed by the erection of Callendar itself to the rank of an earldom also. One of the most noted members of this remarkable family was James, second son of Alexander the first earl, and afterwards chief of the stock himself. While quite young he entered the service of the great Gustavus of Sweden with a troop of Falkirk volunteers, and there remained for many years, covering himself and his following with widespread renown. On his return, the fame he had carved out for himself was endorsed by the king raising him to a separate peerage as Lord Livingstone of Almond and Falkirk, the Callendar earldom also subsequently falling to him through the failure of his elder brother's line. In the troubles which ensued between Crown and Parliament Earl James remained faithful to the former, first fighting by the side of Montrose, both in Scotland and in England, and then with his personal following at his back sharing in the Scottish raid upon the English Parliamentarians, known as the "Hamilton engagement." After the execution of Charles at Whitehall and Montrose at Edinburgh, Charles II. thought to retrieve fortune by means of the forces of the Scottish estates. On invitation he came from Paris to Scotland and entered upon a disastrous campaign, during a few days of which himself and suite occupied as head-quarters a part of Callendar Castle. On the approach of Cromwell from the east, Charles and the Scottish army withdrew northwards, leaving Callendar in the keeping of a garrison partly made up of the fighting townsmen of Falkirk. Cromwell carried the castle by storm, after a vigorous resistance during which its defenders were cut down almost to a man, the occurrence forming the first recorded instance of Callendar Castle succumbing to an attack of the enemy, though menaced many scores of times before. Earl James was the while with the king within the Scottish lines barely three miles away; and when it was resolved to shirk an issue with the victorious Cromwell, and rather make for England by forced marches in the hopes of exciting a royalist rising there, Callendar accompanied the enterprise, shared in the Worcester defeat which followed, and finally accompanied the king on his flight to the Continent where he remained for ten long years, until the epoch of the Restoration. Monk, as Cromwell's lieutenant in Scotland, occupied the dismantled fortress of Callendar as a residence during the space of no less than five years, and it was from this quarter that, after the death of Cromwell, he marched southward upon London and took crafty order for a masterful restoration of the monarchy. Earl James returned with his sovereign, and in the comparatively peaceful times which followed set himself to the repair of the old castle. The conditions of assault and defence had entirely changed, and no effort was now made to restore it to the grade of an efficient place of strength. The ruins of the outer wall or barbican were removed; the moat began to be filled up gradually; the inner defending curtains were also fully rooted out; and the ancient massive keep of the disrated fortress eventually stood confessed, in the repairs and trifling additions the restored possessor had seen fit to execute. The famous Earl James died peaceably at home after all his wanderings and adventures, and being without issue, was succeeded by his nephew Alexander, who afterwards strange to note sided with the Covenanters against the king, and shared in the misfortunes which fell upon that cause. Deprived, by way of penance, of the old hereditary powers of bailery and justiciary, &c., Earl Alexander directed his attention to the further improvement of the family mansion, putting such a general face upon it as was destined to remain practically undisturbed for more than a century thereafter. Alexander was succeeded by his son James, fourth Earl of Callendar, who afterwards, through the decease of his uncle without heirs, became also fourth Earl of Linlithgow. James was the last of this noble line. With the customary genius of the family for espousing the side destined to lose, he threw in his lot with the old Pretender in 1715, and for reward had his family attainted; he himself escaping with bare life to the Continent, where ten years afterwards he died, leaving one daughter only. At the date of the attainder, this ill-starred stock had in its possession the three earldoms of Callendar, Linlithgow, and Newburgh, along with numerous baronies and other minor honours. The disinherited daughter of the house, Lady Anne Livingstone, afterwards married Earl Kilmarnock. Callendar House and property passed as a purchase speculation from the Crown into the hands of a London concern, called the York Buildings Company; but this syndicate finding it impossible to draw rents from the tenantry, who clamoured for the re-instatement of the old family, concluded a financial agreement with Lord and Lady Kilmarnock, whereby they entered upon a long lease of occupancy with all the functional rights of proprietorship, an arrangement which worked to mutual satisfaction while it lasted. Earl Kilmarnock became implicated in the rising of 1745. The famous battle of Falkirk was fought on the Callendar estate itself, and Prince Charlie, under the very shortlived glimpse of success which immediately succeeded that event, tasted the hospitality of the mansion so familiarly known to his ancestors. The play ended, however, after Culloden, with misguided Kilmarnock on the scaffold at Tower Hill; the widowed Countess of Kilmarnock continued the leasehold of Callendar a few years longer, and then the place knew the ancient family no more.

Callendar House and estates were, in 1780, purchased by a scion of the Forbes family of Colquhany, Aberdeenshire, and in this possession they still remain, Mr. William Forbes, the present proprietor, being the third of the new dynasty and the grandson of the original purchaser. In 1842 the Queen and Prince Albert, shortly after the royal marriage, honoured Callendar with a visit on their way from Stirling to Edinburgh, and were received by Lady Louise Forbes and her son William, the present proprietor, at that time a lad, the lord of the manor himself forming part of the escorting *cortège*. The first of the new line, who wisely refrained from building on a new site though tempted to do so, added wings to the old-fashioned looking mansion, relieved the ancient baldness of the façade by octagonal towers, and remodelled the roof. The second Mr. Forbes (who for some years sat in Parliament for the county in the Conservative interest) contrived a projection of the central wall of the façade, and erected a new porch and entrance-hall, all with good effect; but to the present proprietor has been left the main work of addition, renewal, and renovation, covering a series of years and finally completed about five years ago only. Callendar House, though the same building in its foundations and principal masonry as that which Cromwell took by storm, is now vastly transformed in the appearance presented to the eye. It is a handsome and spacious edifice unquestionably, yet with a distinct, unmistakable, and very precious flavour of the unceremonious centuries through whose rudeness and hard knocks it has come down undestroyed to our own day. The style may be called Old Baronial, though it cannot be said that the architectural canons have been rigidly adhered to in details. The evidences of conspicuous antiquity are much more numerous inside the edifice than outside. "Queen Mary's Room," which is still maintained in ordinary habitable occupation, shows walls fully 7 ft. thick, a massiveness which is quite matched, if not exceeded, in other parts of the building. The mansion is surrounded by 500 acres of beautifully-wooded grounds, interspersed with orchard, vinery, and garden patches, and rejoicing in various specimens of water ornamentation. The Callendar estate, in its entirety, extends to about 15,000 acres, now for the most part under remunerative cultivation, while beneath the surface valuable mineral strata are abundant.

## CIRCULAR HOSPITAL WARDS.

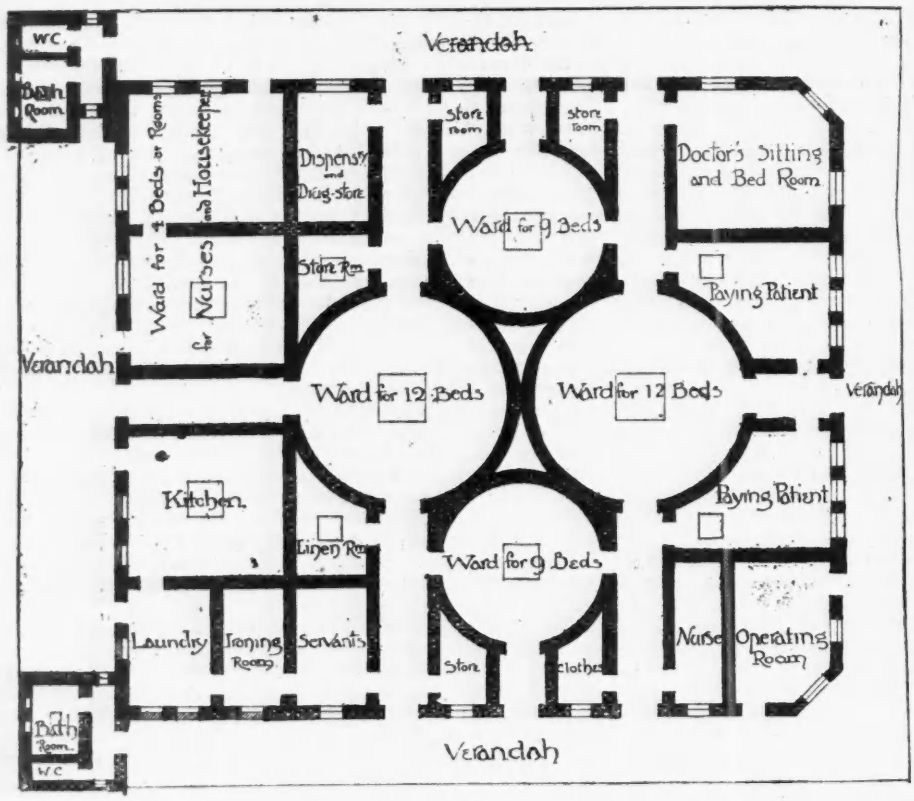
SIR,—In forwarding you, with Lady Strangford's instantly granted and hearty acquiescence, her ladyship's plan for a hospital with circular wards, which is proposed to be built at Port Said, for our sailors and marines, and is, possibly, to be repeated at Constantinople, I will ask leave to append a few remarks.

Lady Strangford's design is intentionally adapted throughout for an Oriental and hot climate. It is a one-storied building. The four circular wards are placed in the centre of the establishment, so as to be protected from the heat and glare of the sun; with a similar intention, and also to insure quietude, these wards have no windows in their surrounding walls, but they are lighted from above by a lantern-shaped window or opening, which can be completely shuttered on the south; the arrangement by which each ward will admit of three air-currents from the outside is very simple, and most ingeniously carried out; the upward ventilation, characteristic of a domed circular apartment, is here aimed at, and will, I believe, assuredly be effected. The position, size, and mode of appropriation of the several rooms situated around the circular wards have evidently been most carefully thought out. The special sanitary accommodation is judiciously provided for, and the enclosing verandah forms an essential feature of an entirely admirable design, remarkable alike for its symmetry and completeness.

In a letter to me, accompanying her plan, Lady Strangford alludes to the fact that in the East, in Egypt especially, every house "above the peasant's mud cabin has all its rooms domed, except the smallest. The opening above has a lantern-shaped frame for windows, which are seldom put in; the opening is mostly left open to the north, the south being often closed with a board."

But, although Egyptian dwelling-rooms are domed, they are not themselves necessarily or usually circular; and it is the introduction of the circular form for the ward itself, and its completion into the dome above, which constitute the chief element of novelty in Lady Strangford's design. This special adaptation of a "windowless" circle to the requirements of a hospital ward in a hot climate, affords a most interesting example of the application of the circular principle in ward-construction.

Looking at the subject from a purely Oriental standpoint, Lady Strangford remarks that "it must be difficult to render them [circular wards] cheerful" in England. "A windowless room," she observes, "in these climates, and under our terrible skies, is usually very depressing. But in the East, where my practical experience in building has mostly lain, the case is different; and you may like to know that in



HOSPITAL OF ONE STORY, WITH CIRCULAR WARDS, FOR EGYPT,

DESIGNED BY THE VISCOUNTESS STRANGFORD. 1884.

122 ft. by 106 ft. externally. Walls, 2 ft. thick throughout.

| | | | | |
|---|---|---|---|---|
| 2 circular wards, | 12 | beds each, | equal to | 24 beds. |
| 2 „ „ | 9 | „ | „ | 18 „ |
| 2 paying-patient wards, | 1 or 2 | „ | „ | 2 or 4 beds. |
| 1 ward, if necessary | 4 | „ | „ | 4 „ |
| | | | | 44 or 50 beds. |

*Lantern of each Room: Windows taken out nearly all the Year.*

my hospital at Cairo, where we had such an inner domed room, we invariably found, to our surprise, our patients did better there than in any other ward, and were always the most cheerful."

I need hardly point out the emphatic testimony hereby offered against the imputation, or prophecy rather, that a circular ward would be monotonous and depressing. Even when such a ward is "windowless," as in Egypt, this is not found to be the case; and, in England or Belgium, where circular wards are abundantly "windowed," it is quite inconceivable that it should be so, unless, indeed, on the supposition that a very *square* patient might feel ill at ease in a *round* place. In relation to this point permit me here to emphasise as strongly as I can the expressions of surprise and delight which I made use of in my address the other evening at the singularly light and cheerful aspect of the interior of one of the large circular wards in the Antwerp Hospital, which I visited last September. Three ladies, members of my family, were equally pleased and astonished.

As to the objection of the possible want of light for the purposes of operation or dressing surgical patients, I may say that it is one which I always thought had no force in it; and it appears to me to be one of those which really have little force except that which every assertion gains by being repeated and repeated. I tested this question at Antwerp. I imagined myself operating, and I placed myself on each side and at the foot of a bed, on which there was a spring-wire mattress, and I found that I could see every wire most distinctly. It seems to me that not only do the numerous cross-lights account for this, but probably, also, there is much light reflected in every direction from the inner smooth and light-coloured surface of the circular walls.

In conclusion, I must thank you for the more than ample justice which you have done to my oral address at the meeting of the Hospitals Association on the 17th inst.;* and I hope that you will allow me on another occasion to communicate to you a few observations on the ventilation of a circular ward.

But I am forgetting Lady Strangford's plan. It is stated in her letter, that it is "drawn for Egypt as the builders there would understand it, and where the construction of domes is extremely cheap and easy."

Lady Strangford tells me that she proposes once a year to strip the circular wards of their destructible contents, to burn these latter outside the building, and to renew them. I suggested that the cremation should take place in the middle of the wards, and by the addition of sulphur or other fumigants, the fire itself would act as a purifier.

I have, indeed, often suggested that circular wards might be built, in sections, of iron, just as large caissons are; and then that they could be lined with wood or other material, which might periodically be burned and renewed.

JOHN MARSHALL, F.R.S.

* See *Builder* for Dec. 20, 1884.

**Royal Institution of Great Britain.**—The following are the probable arrangements for the Friday evening meetings before Easter, 1885:—Jan. 16th, Professor Tyndall on Living Contagia; Jan. 23rd, Professor H. N. Moseley, the Fauna of the Sea Shores; Jan. 30th, Professor Ernst Pauer, a short Review of the Works of Living Composers for the Pianoforte (with musical illustrations by Mr. Max Pauer); Feb. 6th, Mr. G. Johnstone Stoney, How Thought presents itself among the Phenomena of Nature; Feb. 13th, Sir John Lubbock, Bart., the Forms of Leaves; Feb. 20th, Mr. William Huggins, the Solar Corona; Feb. 27th, Professor E. Ray Lankester, a Marine Biological Laboratory; March 6th, Charles T. Newton, C.B., the German Discoveries at Pergamus; March 13th, Sir Frederick A. Abel (subject not announced); March 20th, Professor A. W. Bücker, Liquid Films,—a soap bubble; March 27th, Professor Sir Henry E. Roscoe, the Sources of the Coal Tar Colours.

## Illustrations.

### WINDOW IN SOUTH CHOIR AISLE, SALISBURY.

THE two figures given here form a portion of a window executed by Messrs. Wm. Morris & Co. from the designs of Mr. E. Burne Jones. Colour, alas! is wanting in the representation, but we believe all stained-glass artists will concur with us that attempts to render the glow of translucent glass by means of any sort of colour-printing are little likely to be attended with success. We gave last year a chromolithograph of some decorative design by Mr. Poynter, of which a diaper window formed a part; but in that case the glass was only a subordinate part of the scheme, and only a simple pattern in two or three colours. Mr. Burne Jones's colour is not reducible to the same simple elements, and is, therefore, better not attempted. The other half of the window, containing the two other figures, will follow, and we are enabled, by the kind permission of Mr. Burne Jones and Messrs. Morris, to promise a short series of Mr. Burne Jones's executed designs for stained glass,—a form of art in which his peculiar genius, with its tendency towards simplicity of form combined with richness of colour, seems specially to shine, even more than in his easel paintings.

### KEBLE COLLEGE CHAPEL.

ALTHOUGH this chapel has now been in existence for some years, we are not aware that it has been illustrated, and as a specially rich example of modern church architecture, in which an elaborate system of decoration has been carried out, it is a building of which we wish to have a record in our pages. Mr. Butterfield, from whose designs, as is well known, it was erected, sends us the following particulars in regard to the chapel and its decoration.

The principal features of the decoration of the interior are painted glass in the windows, and mosaics in panels on the walls. These illustrate,—as completely as the space will allow, and in some sort after the manner of the Christian year,—the successive dealings of God with His Church: Patriarchal, Jewish, and Christian, They bring out, by means of type and antitype, the relationship of the Old to the New Testament, and show the process of God's gradual revelation of Himself in Christ.

The histories of Noah, Abraham, Joseph, and Moses in twelve of the side panels of the western half or nave of the chapel, with the figures of the twelve minor prophets in the four windows above, and of the four greater prophets with David, Solomon, Samuel, and Elijah in the west window, refer to the earlier dispensations.

A series of events from the New Testament, viz., the Annunciation, the Nativity, Baptism, Crucifixion, and Resurrection of our Lord, represented in mosaic, are placed in panels in the eastern half or choir of the chapel. The Ascension of our Lord is represented in the glass of the east window.

The series of mosaics is continued and completed in a mosaic quatrefoil panel, above the altar-piece below the east window, which represents our Lord as He finally revealed Himself after His Ascension to St. John, in the Isle of Patmos, "one like unto the Son of Man," present in His Church now and till the end, the Church being symbolised by the seven candlesticks around Him, and her chief ministers by the seven stars in His right hand. It conveys to the eye the promise given of His perpetual presence in her.

Christian saints, in mosaic panels on either side of this centre figure, support it. The Greek and Latin Doctors are represented in the four side windows above, the Latin Doctors being in the two windows on the north side.

In the north and south transept windows are central figures of St. Peter and St. Paul, with one of the four Evangelists on either side of each Apostle.

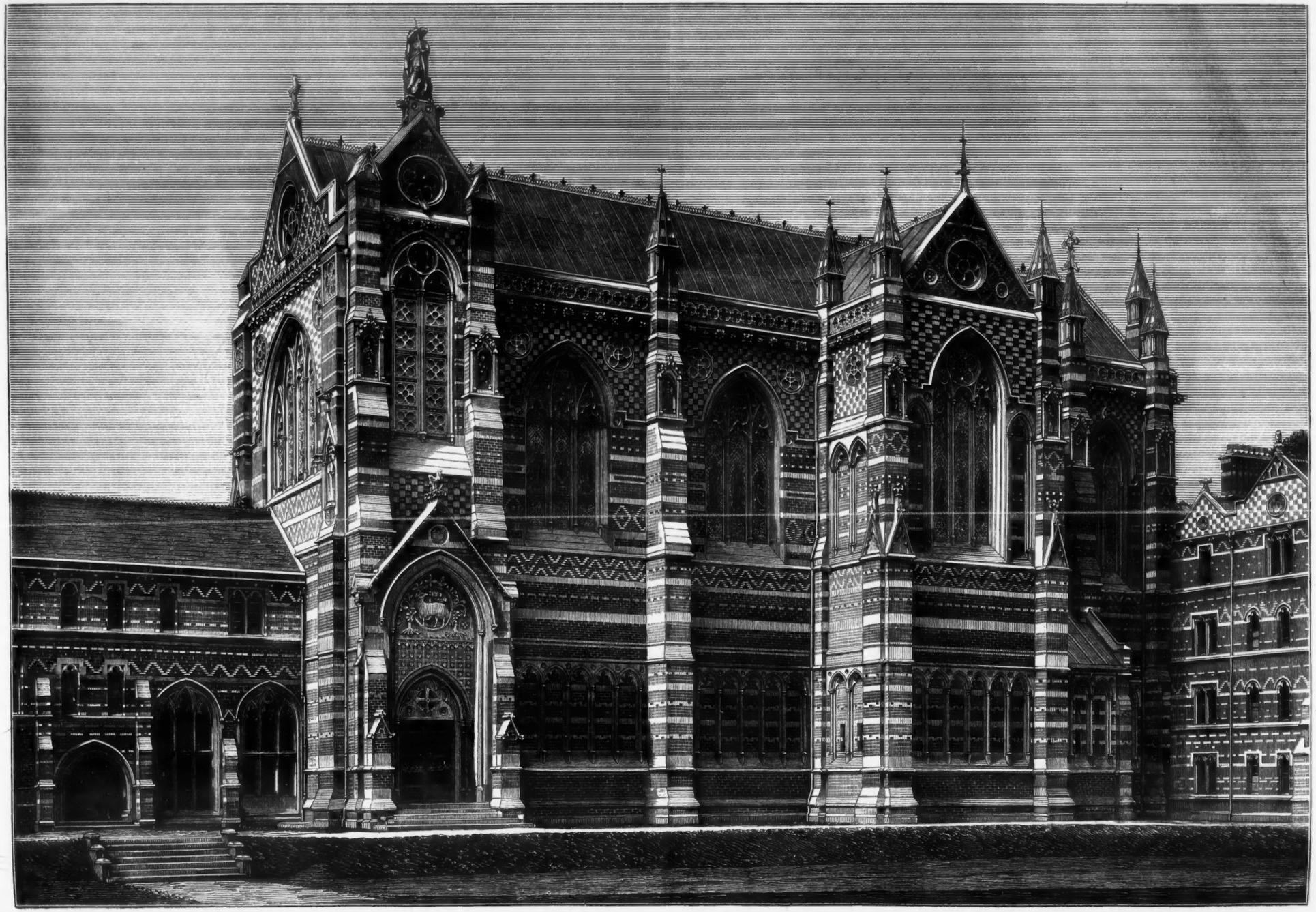
Along the entire west end of the chapel is depicted in three mosaic panels the future second coming of our Lord to judgment. He is enthroned with the Apostles, and is attended by angels, bearing the instruments of His Passion, the cross, the crown of thorns, the spear, and the nails. The figure of St. Michael the Archangel in the centre of the lower part of this

ANGEL MUSICIANS

"INK-PHOTO", SPRAGUE & Cº. LONDON.

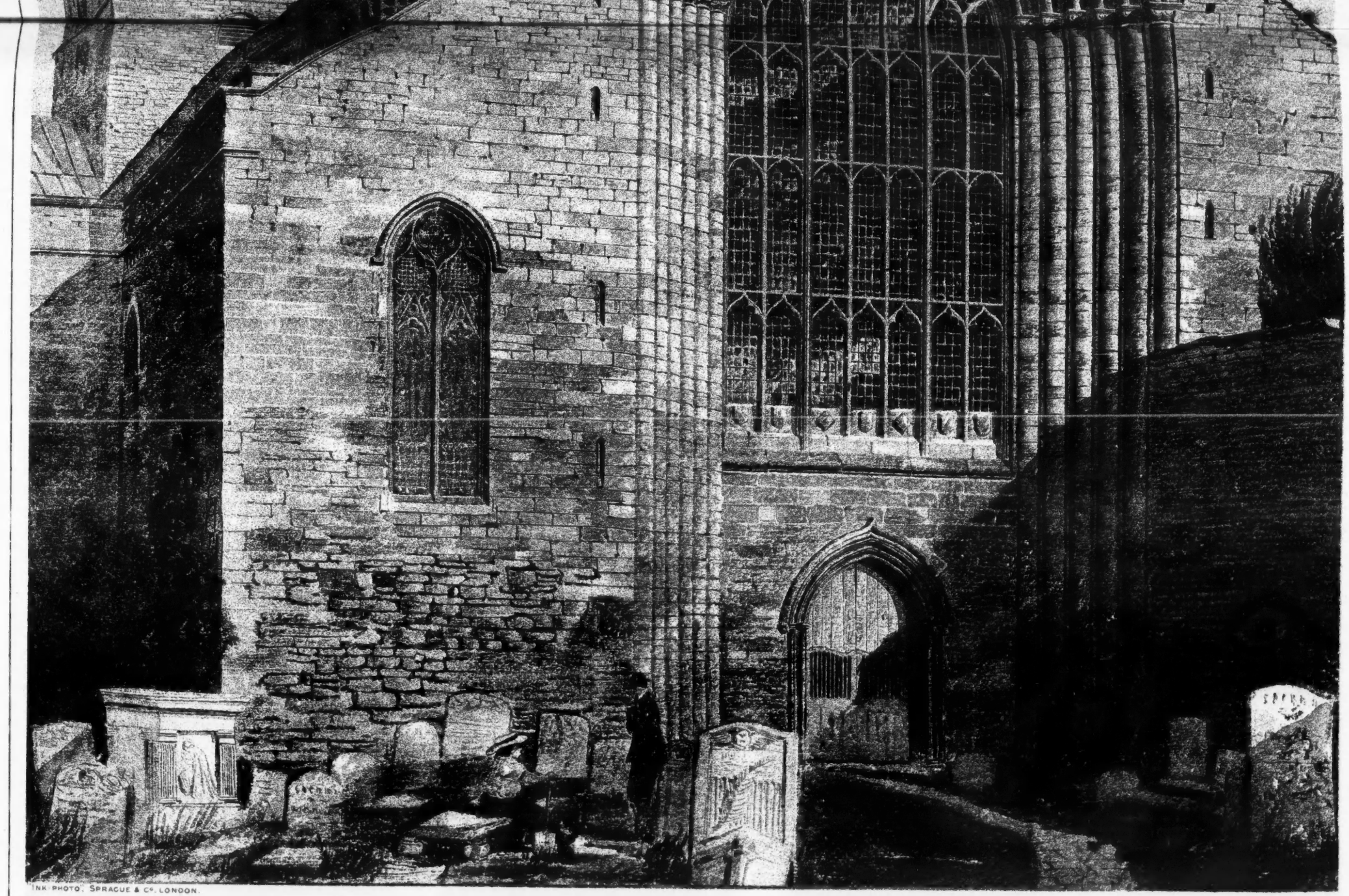
FROM A WINDOW IN THE SOUTH CHOIR AISLE, SALISBURY CATHEDRAL.

DESIGNED BY MR. E. BURNE-JONES.
EXECUTED BY WM. MORRIS & CO.



THE CHAPEL KEBLE COLLEGE, OXFORD.—MR. W. BUTTERFIELD, ARCHITECT.

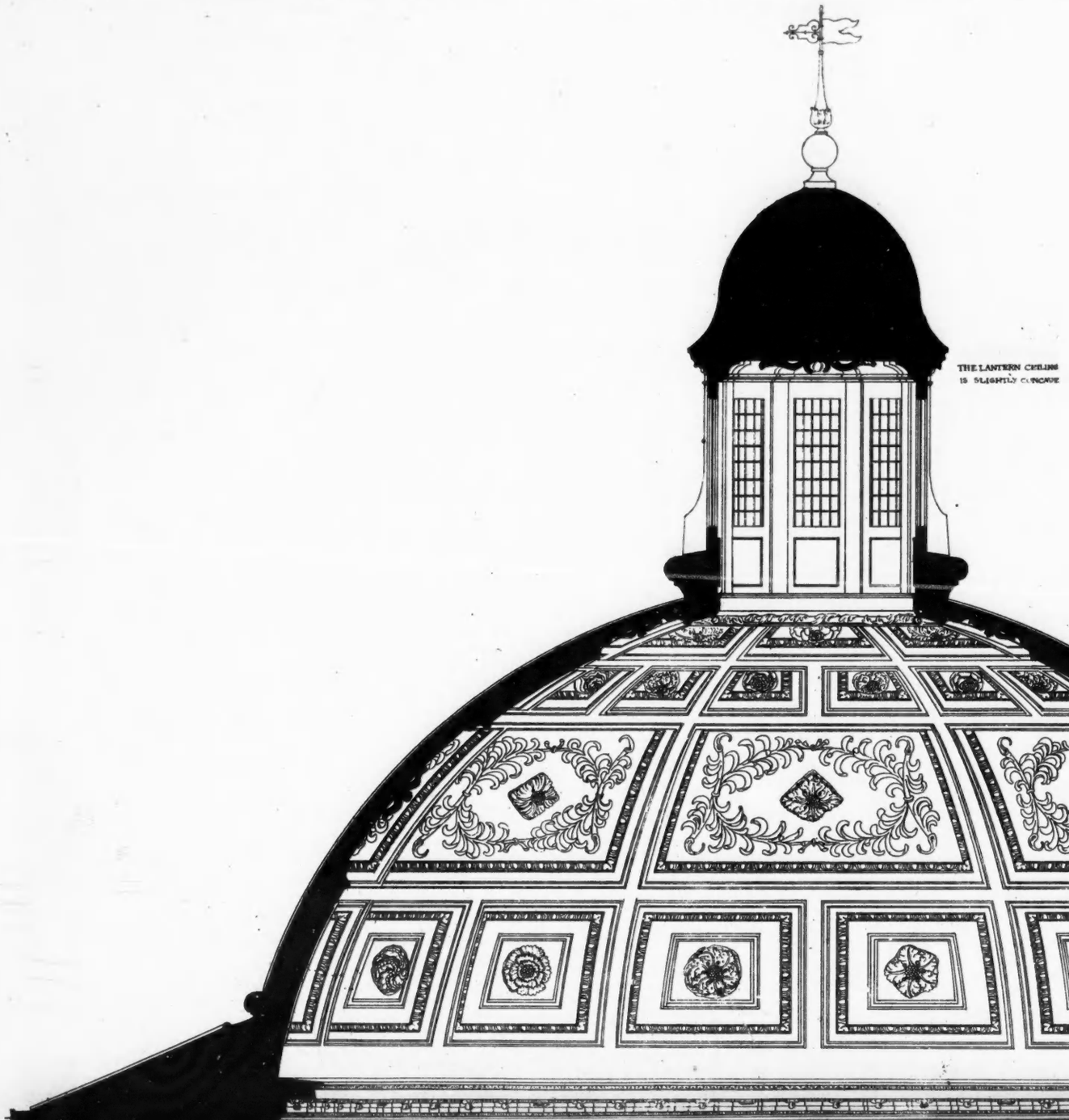
THE CHAPEL, KEBLE COLLEGE, OXFORD.—Mr. W. Butterfield, Architect.



INK-PHOTO. SPRAGUE & Co. LONDON.

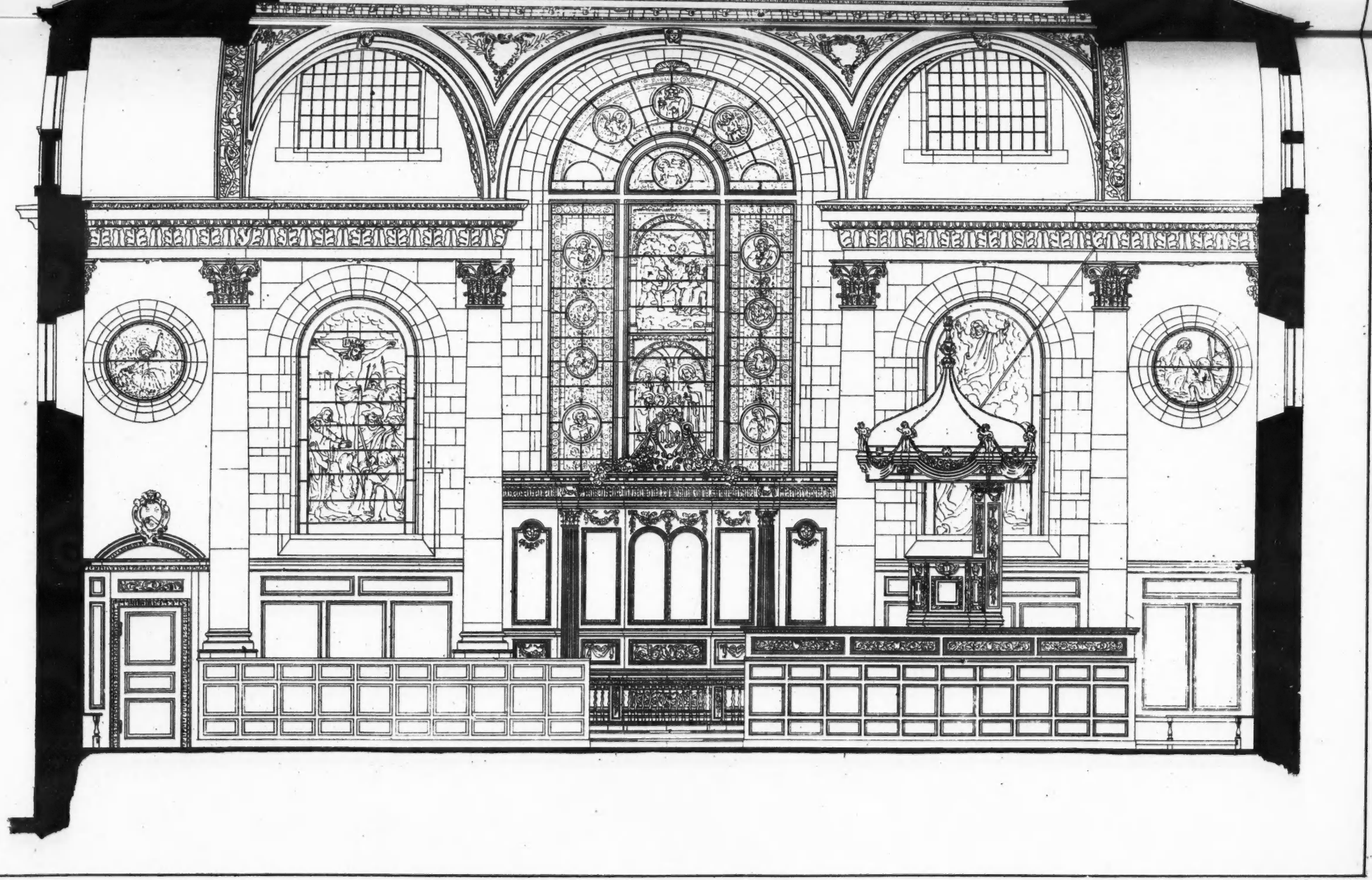
WEST FRONT TEWKESBURY ABBEY.

FROM A DRAWING BY H. H. STATHAM.



THE LANTERN CEILING IS SLIGHTLY CONCAVE

N.B. THE STAINED GLASS IS ONLY SKETCHED IN, AND NOT MEANT



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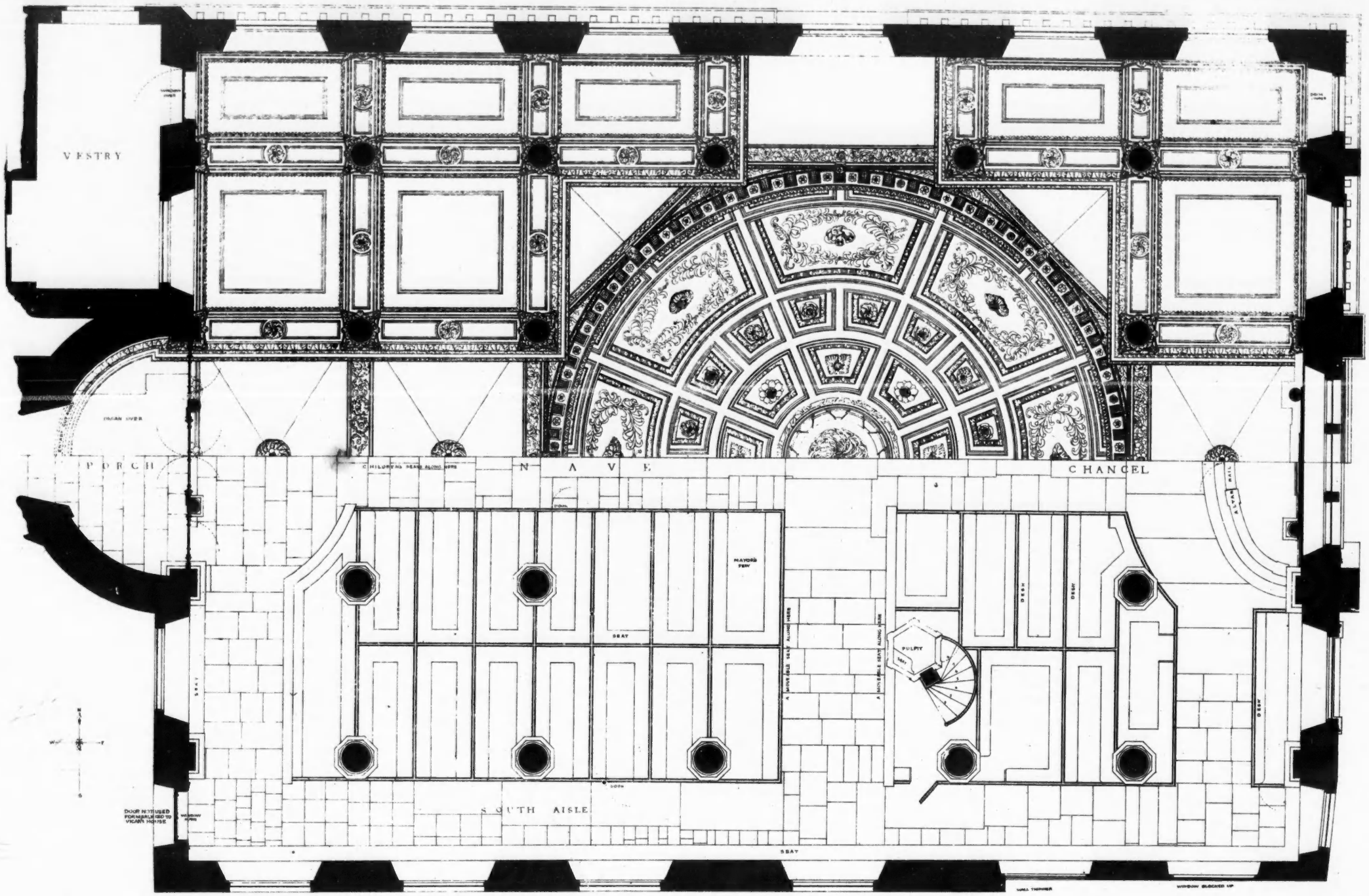
ST. STEPHEN'S CHURCH, WALBROOK: TRANSVERSE SECTION.

*Measured and Drawn by* Mr. Emdund H. Sedding.

First R.A. Medal for Architecture, 1884.

HALF PLAN - LOOKING UP




HALF PLAN LOOKING DOWN

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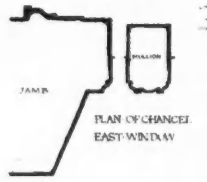
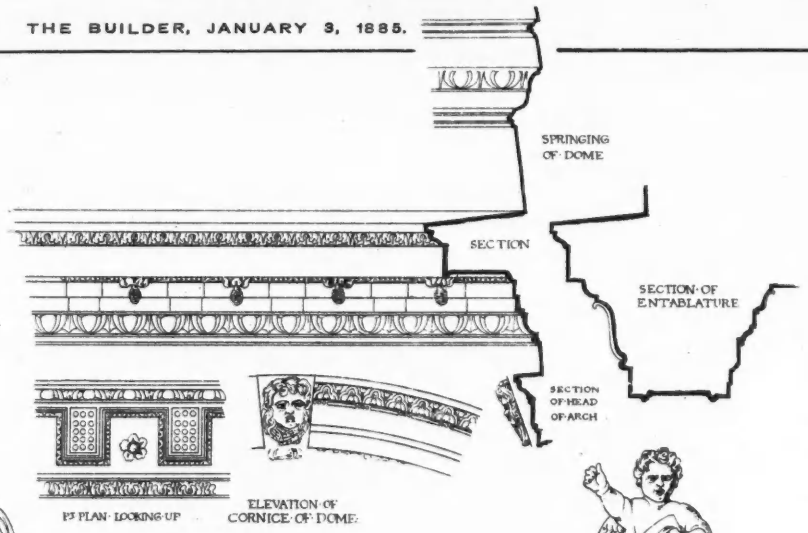
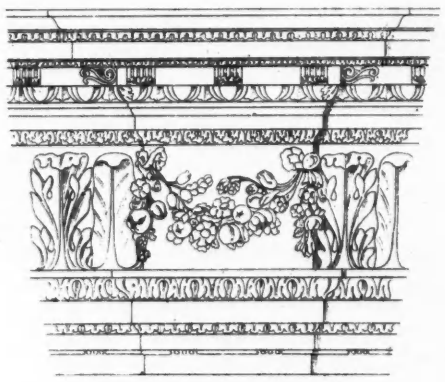
ST. STEPHEN'S CHURCH, WALBROOK. PLANS.

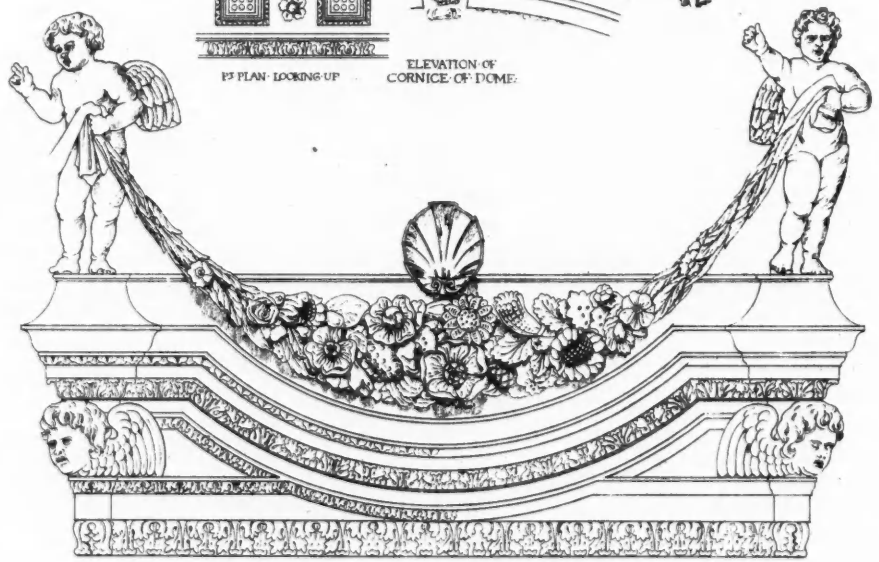
*Measured and Drawn by* MR. EDMUND H. SEDDING.

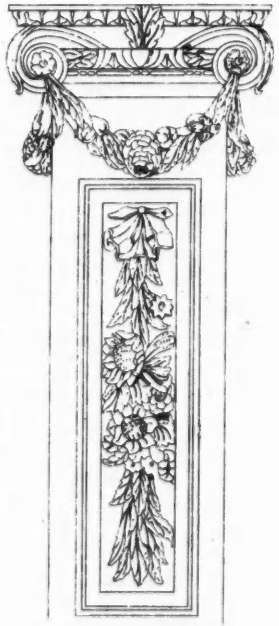
FIRST R.A. MEDAL FOR ARCHITECTURE, 1884.

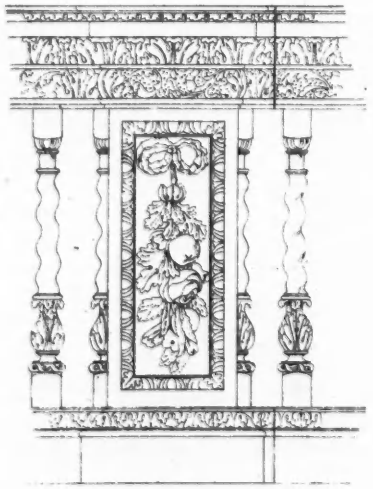


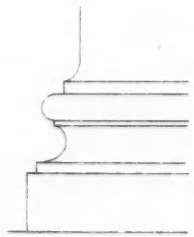



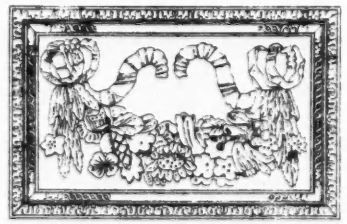



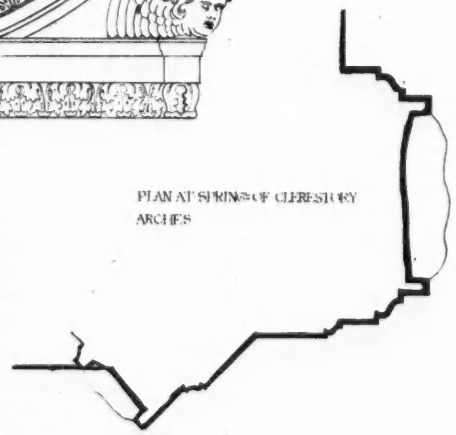

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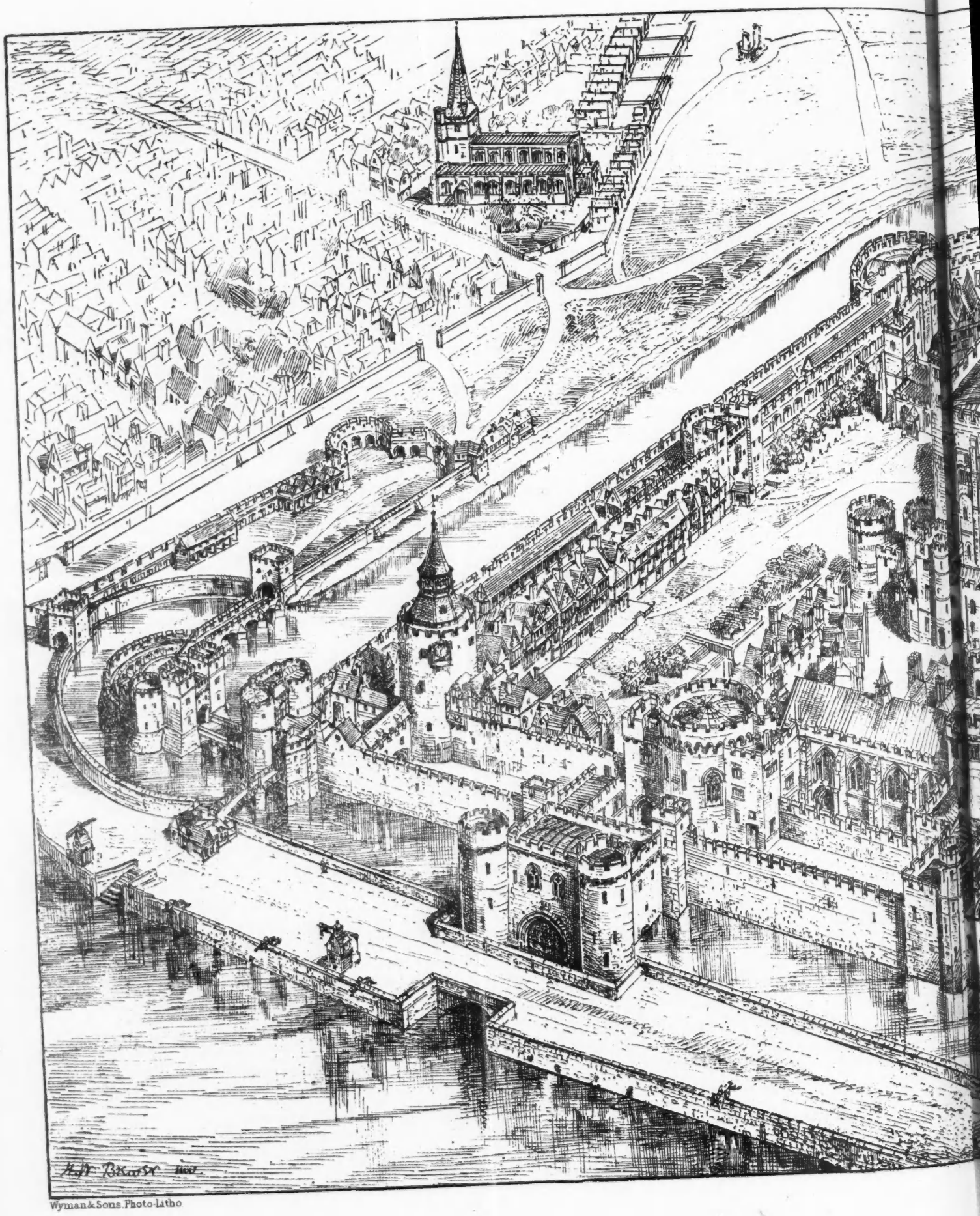
## ST. STEPHEN'S CHURCH, WALBROOK: DETAILS.

*Measured and Drawn by* MR. EMDUND H. SEDDING.



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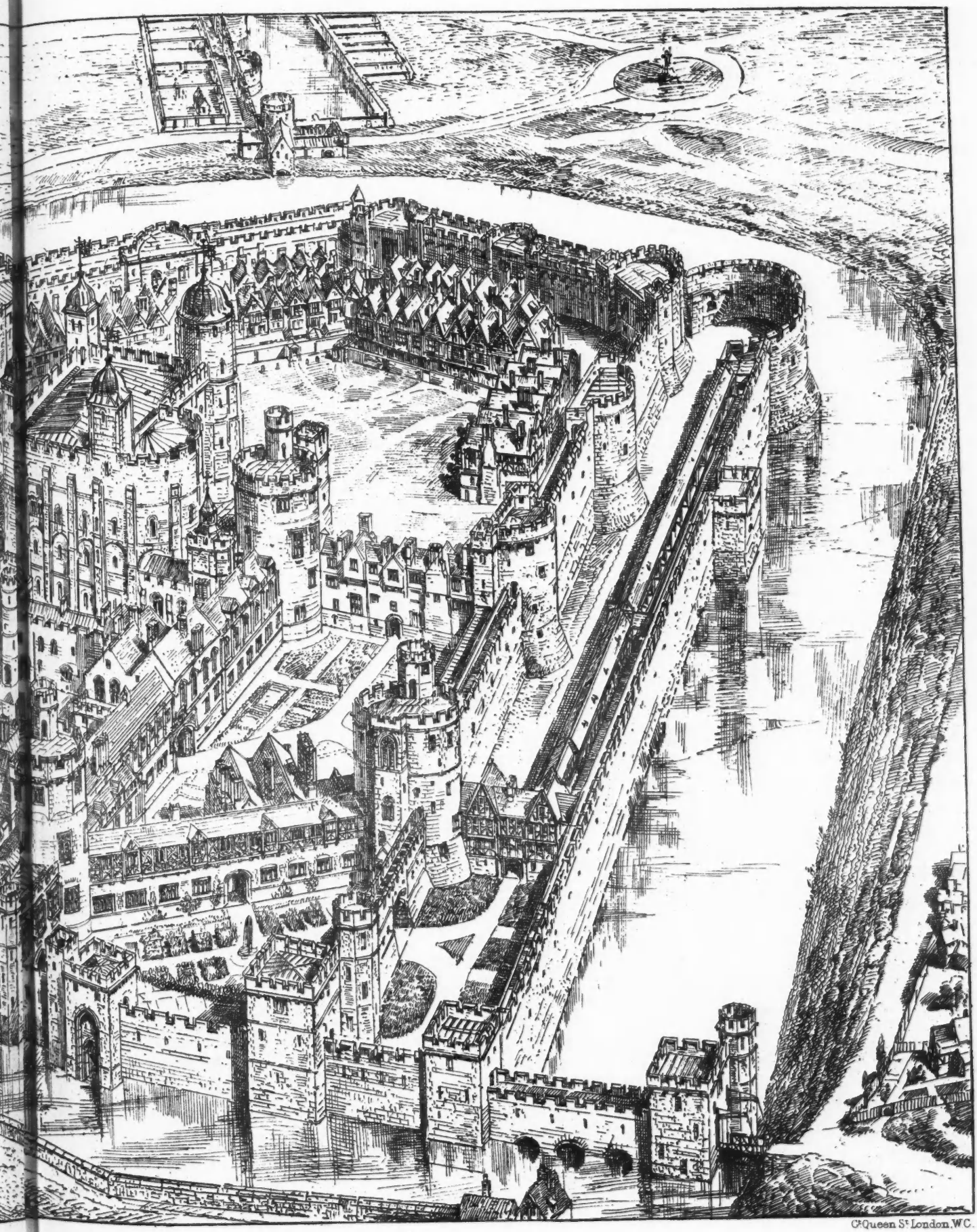
THE TOWER OF LONDON IN



C.Queen St London.W.C.

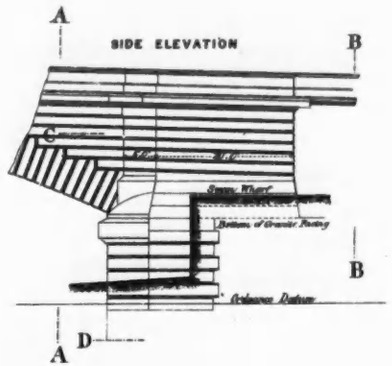
I THE TIME OF ELIZABETH.

# PUTNEY BRIDGE

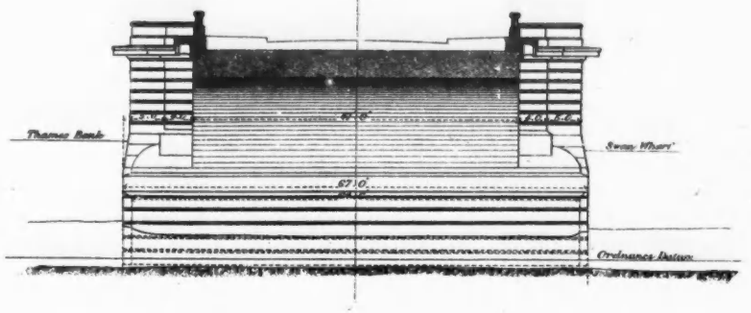
PART ELEVATION.

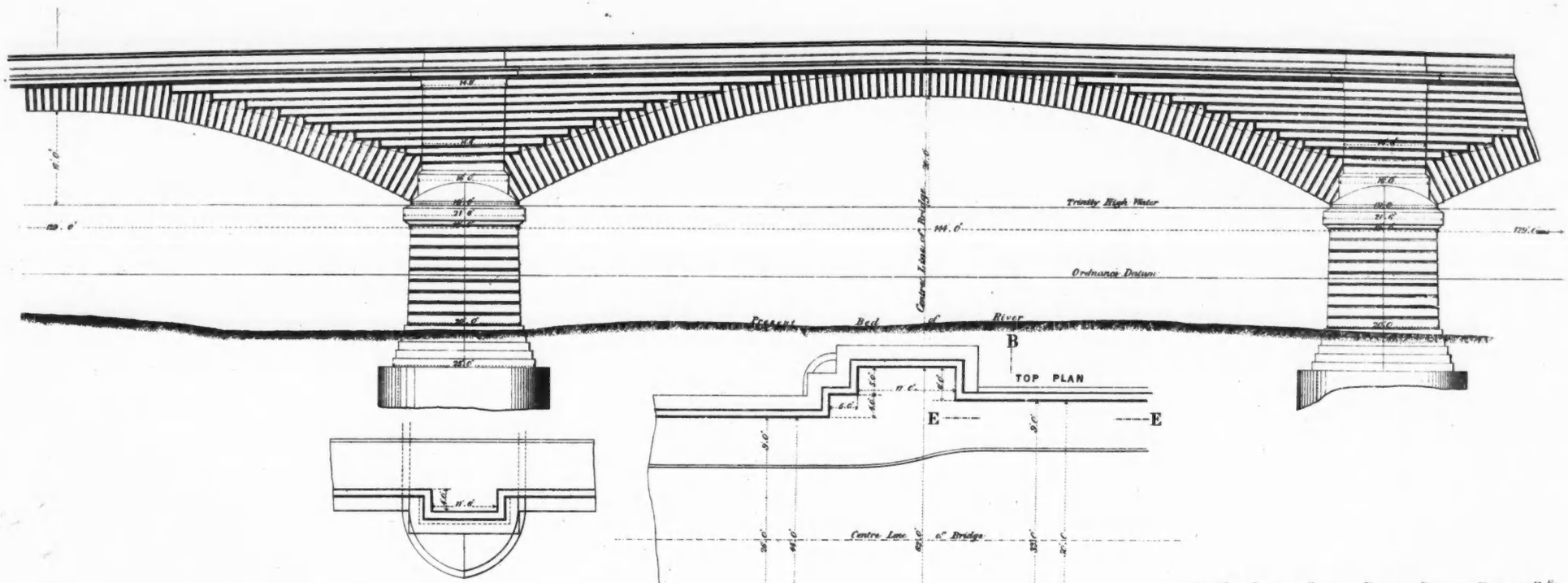
CONTRACT DRAWING

SIDE ELEVATION




MIDDLESEX ABUTMENT
FRONT ELEVATION

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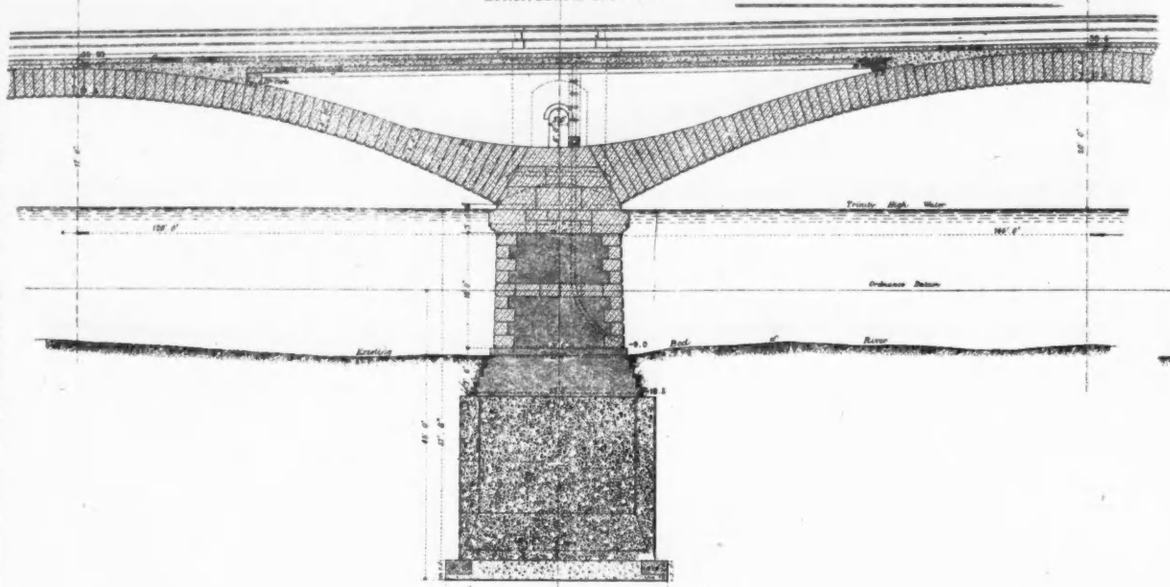
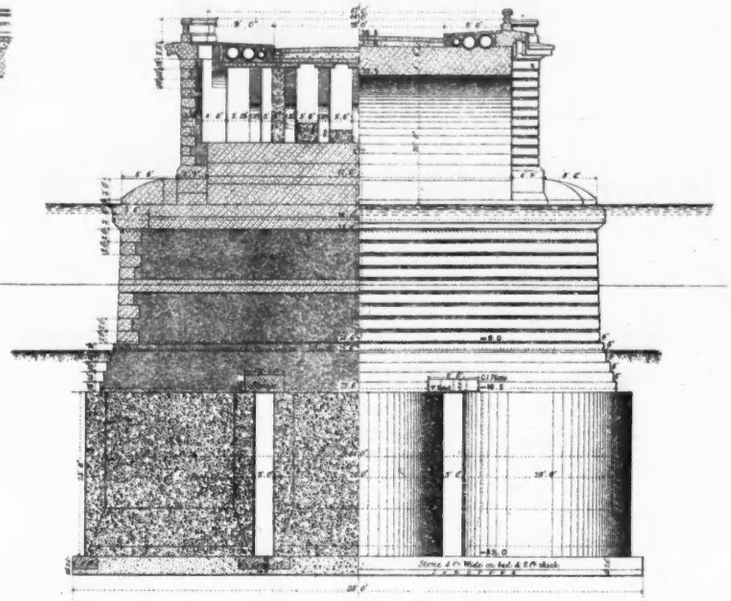
# PUTNEY BRIDGE

LONGITUDINAL SECTION

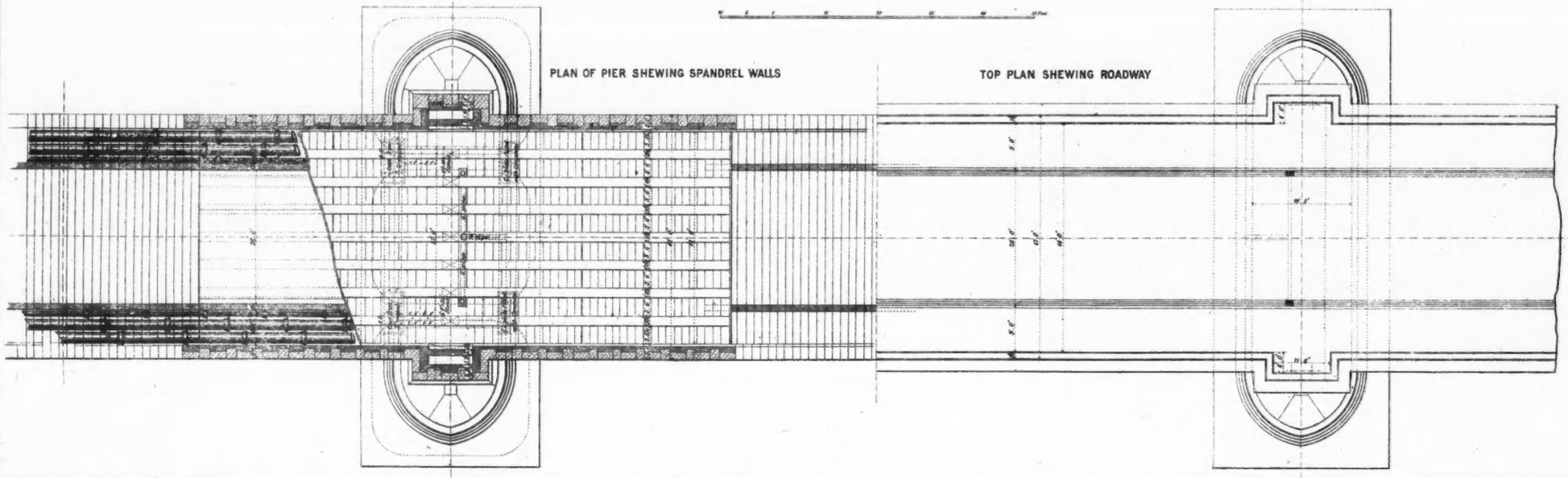


CROSS SECTION



PLAN OF PIER SHEWING SPANDREL WALLS

TOP PLAN SHEWING ROADWAY



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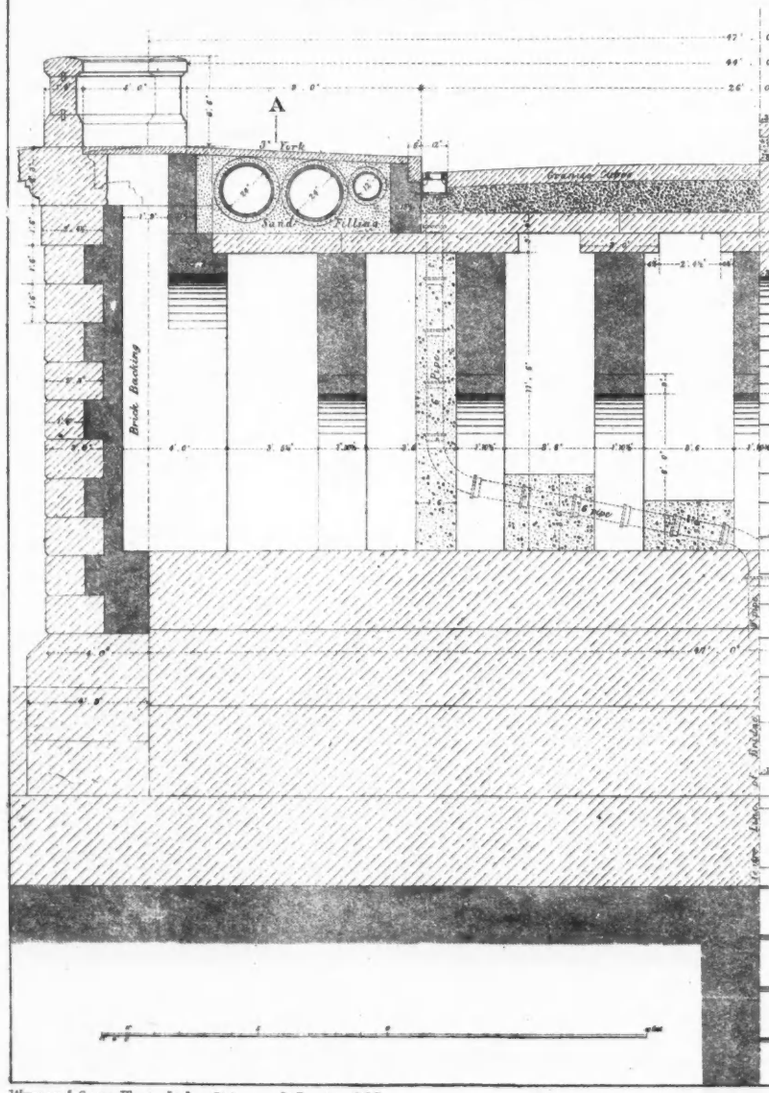
# PUTNEY BRIDGE

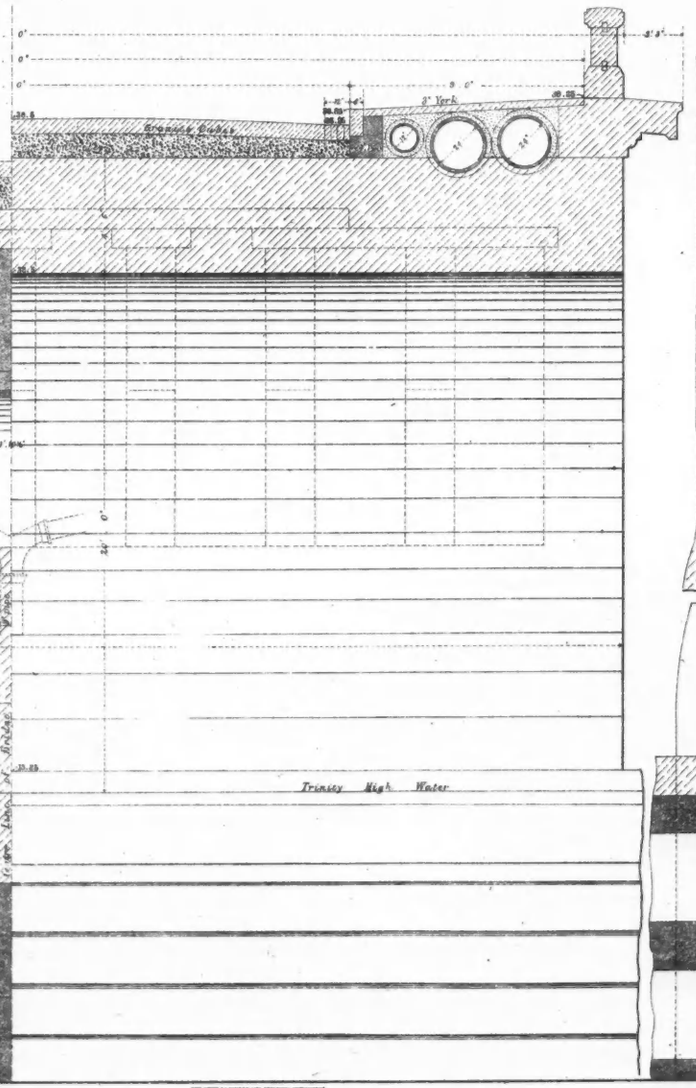
## DETAILS

CONTRACT DRAWING

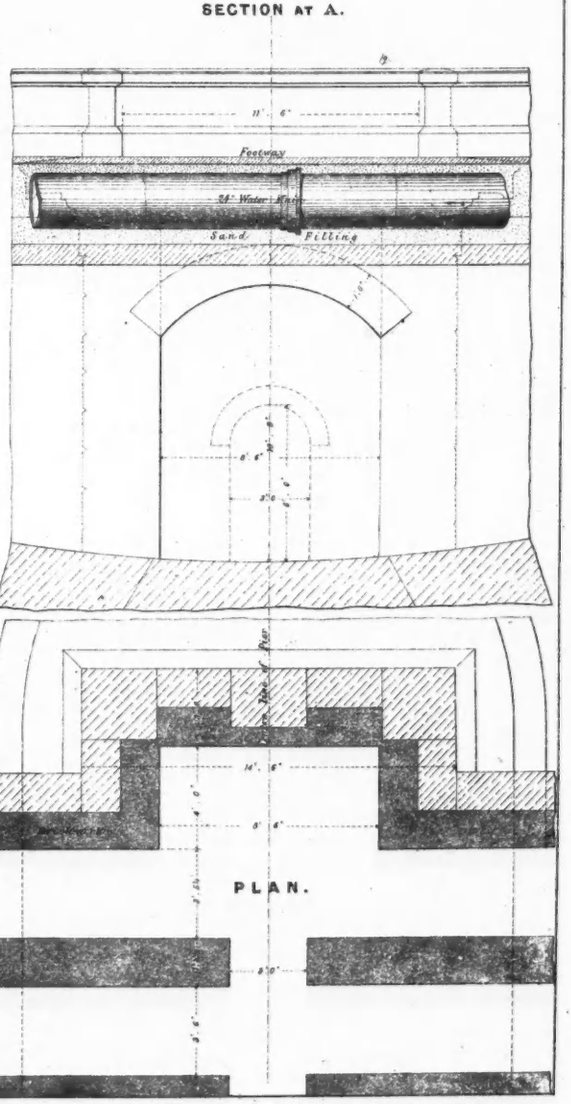
CROSS SECTION OF PIER.



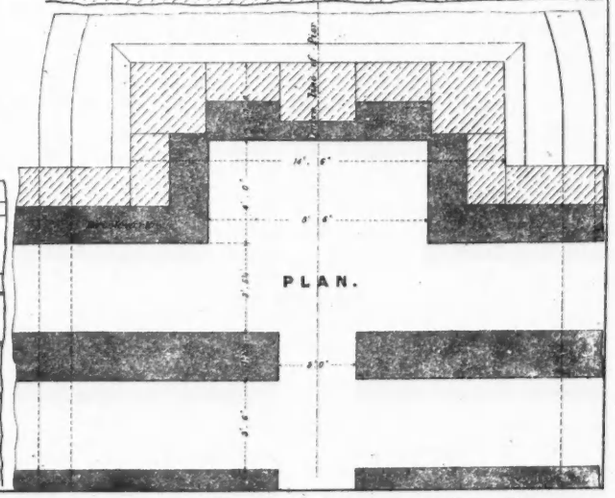

CROSS SECTION AT CENTRE OF ARCH.




SECTION AT A.




PLAN.



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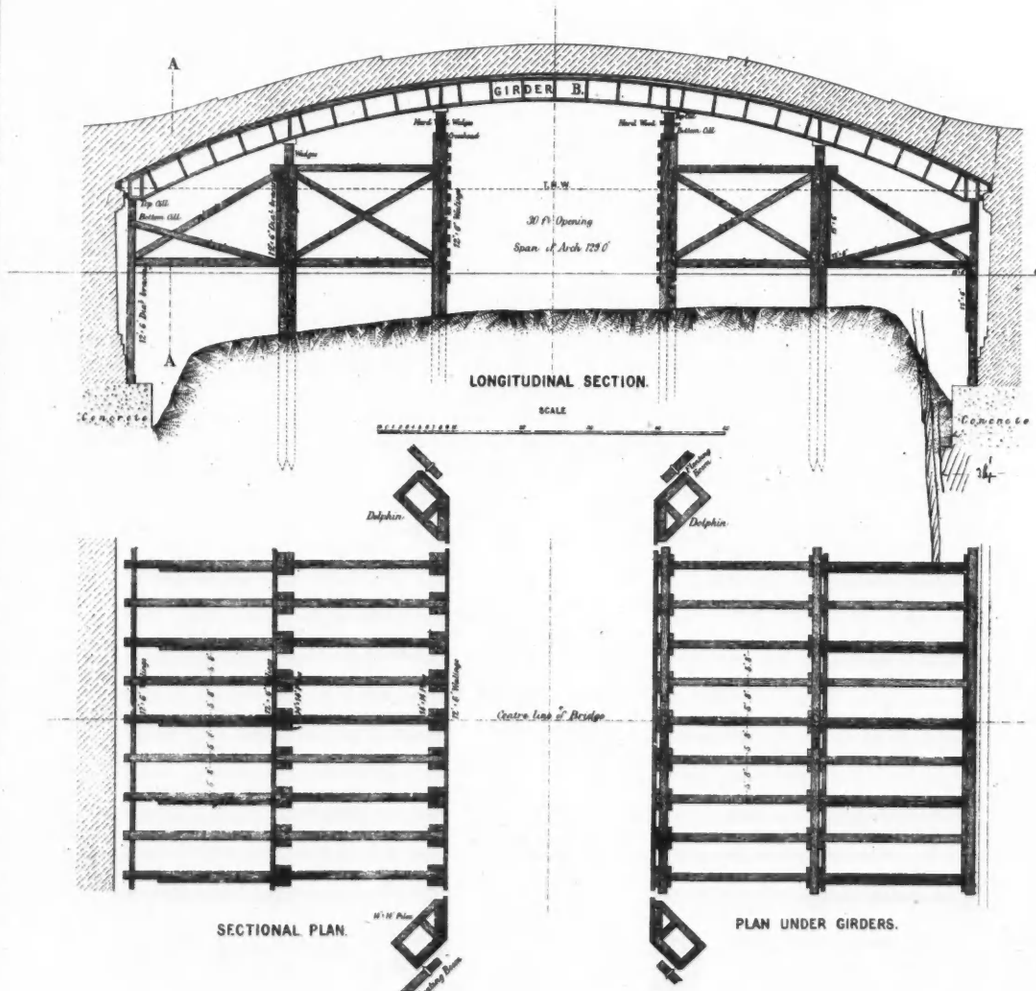
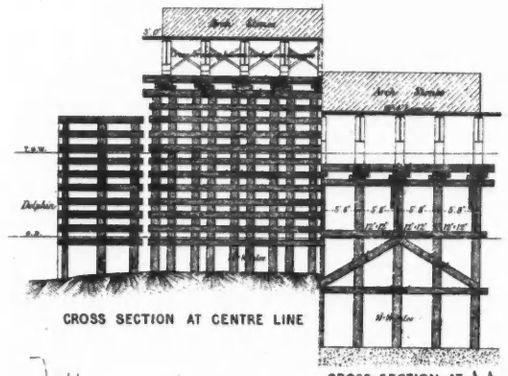
SIR J. W. BAZALGETTE, C.B., ENGINEER.

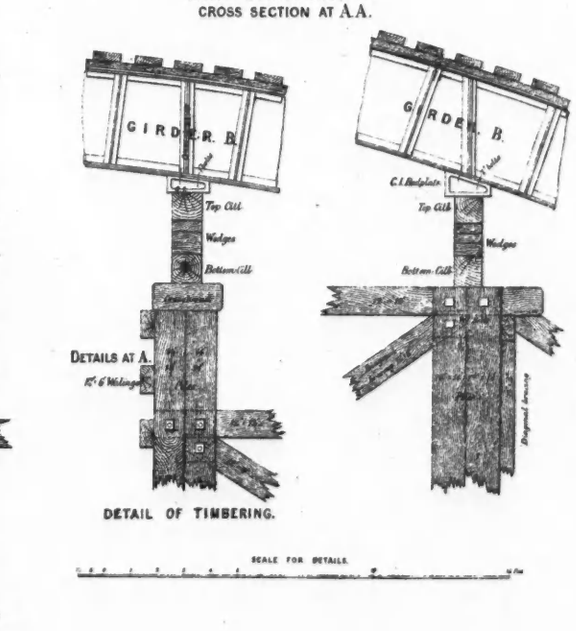
CONTRACT DRAWING

# PUTNEY BRIDGE

## CENTERING FOR INTERMEDIATE ARCHES

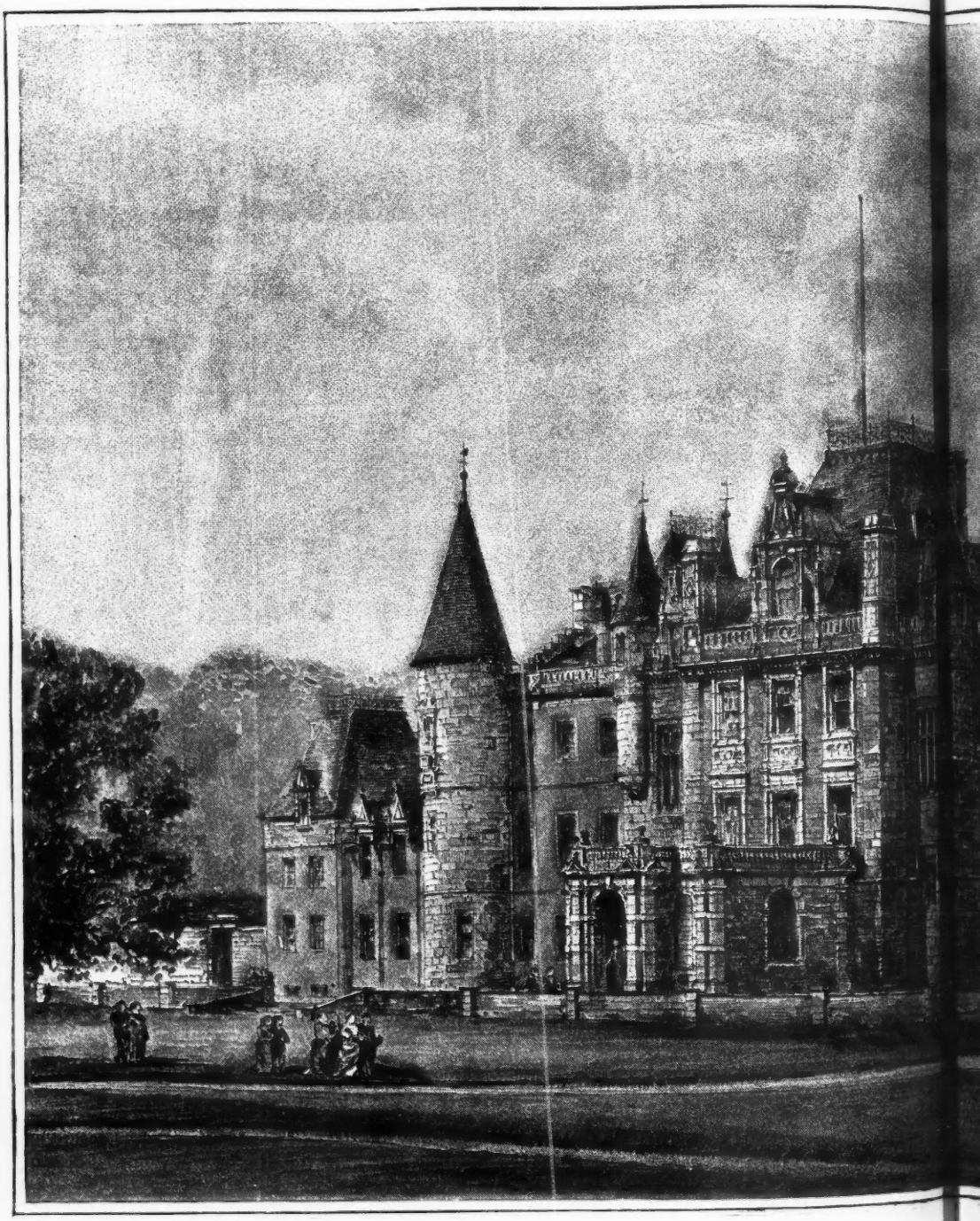


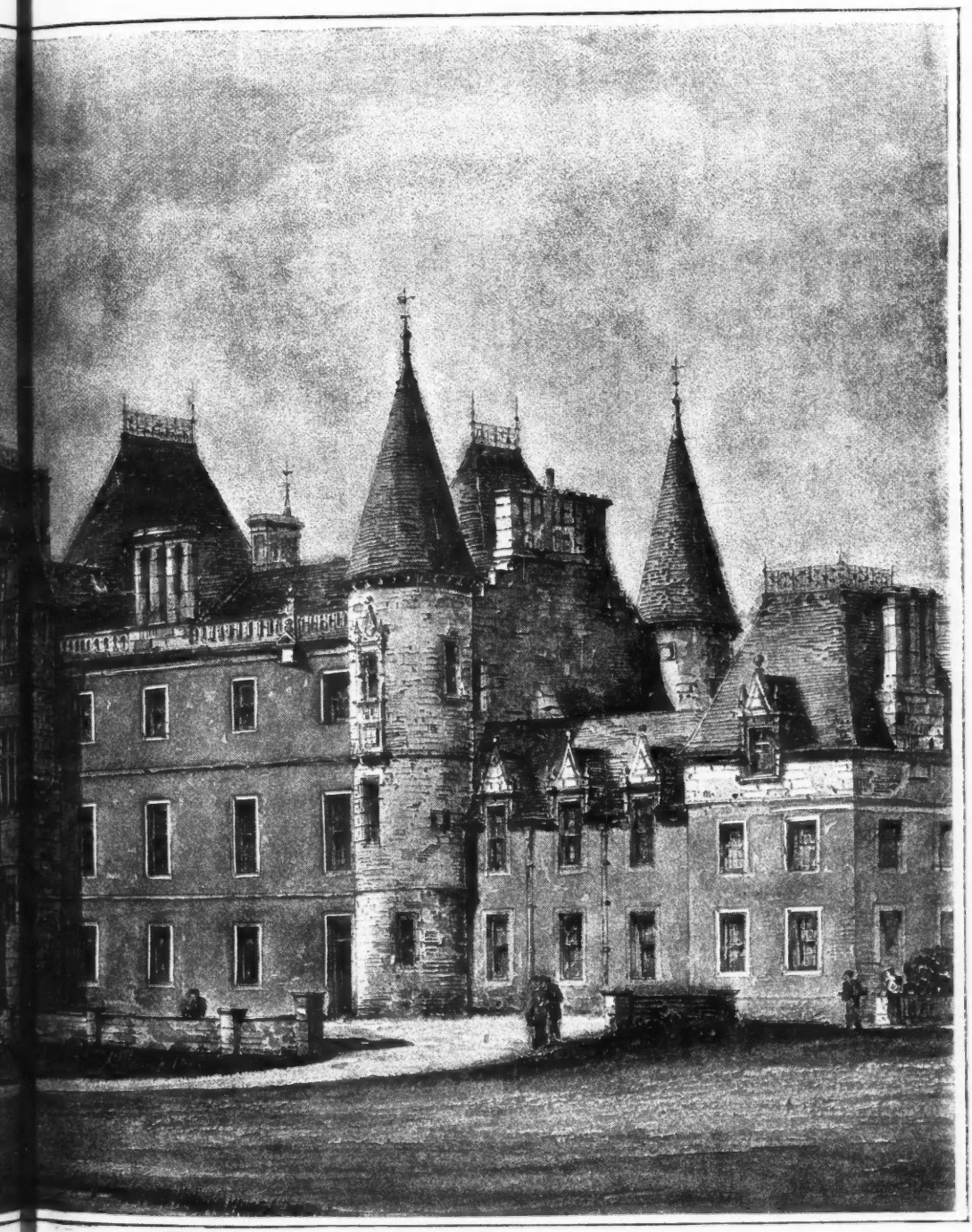




Wyman & Sons, Photo-Litho. Gt Queen St London, W.C

SIR J. W. BAZALGETTE, C.B., ENGINEER.



CALLENDAR HOUE,



UE, STIRLINGSHIRE.

picture divides the saved on the right hand from the lost upon the left hand of our Lord. Along the foot of the middle panel are the words, "Hereafter ye shall see the Son of Man sitting on the right hand of power, and coming in the clouds of heaven."

The outside sculptures are a large figure of St. Michael and the Dragon as a finial to the south porch; and in the two larger and lower niches at the east end are figures of St. Mary in one buttress and the Archangel Gabriel in the other to represent the Annunciation.

A figure of Archbishop Longley, the Archbishop of Canterbury, who laid the first stone of the College buildings, which adjoin the chapel at its west end, occurs in the south-west niche of that front. A large Agnus Dei in relief surmounts the south entrance doorway.

The chapel was the gift of Mr. W. Gibbs, of Tyntesfield.

The engravings have been executed, from photographs, in the *atelier* of Mr. J. D. Cooper.

## WEST FRONT, TEWKESBURY ABBEY.

THIS is from a sepia drawing (made some time ago by the present Editor of this Journal from careful sketches on the spot) of the west front, with its great Norman arch of six "orders." It shows the interpolated west window of debased Perpendicular work, about which, and the propriety of taking it out and replacing it by something in keeping with the character of the Norman architecture, there has been much ink shed, and will probably be more. As a matter of fact, the window is neither a dilapidated affair, as some people have asserted, nor a fine specimen of late work, as others have still more rashly maintained; it is a bad window in good repair. Such as it is, therefore, it had better be left till it becomes dilapidated, when it will be time to consider how to replace it.

The effect of shadow in the deeply-recessed arch is a reminiscence of the actual effect at a time in the afternoon when the western sun just outlined each arch with a line of rich golden light, emphasising by contrast the cavernous recesses of the shadowed portions of the arch, an effect not to be readily forgotten.

## DRAWINGS OF ST. STEPHEN'S, WALBROOK.

THESE drawings, by Mr. Edmund H. Sedding, obtained the first Academy Medal for Architectural Drawing this year. As good and careful drawings they merit publication, and may be useful as a trustworthy delineation of the plan and section and main decorative features of Wren's celebrated church, which, as it has been observed, "has given to the narrow lane of Walbrook a European celebrity," and has received more praise and attention than any building of the same size since the Greek temples,—praise well bestowed on its finely-devised plan and section and spacious appearance, but which must be moderated when we come to consider its decorative detail. However, there is enough in it for modern church builders to learn a good deal from, when once they will take to planning churches on true architectural and not on archæological methods.

## PUTNEY NEW BRIDGE.

WE give this week reduced fac-similes of a portion of the working drawings for the fine new bridge which is in course of construction at Putney, to replace the old picturesque timber bridge, dear to artists, but for some time past in a shaky state in regard to land traffic (heavy weights, such as steam rollers, have been long since forbidden to cross it), and which has always, from its crowded congeries of piles, and its narrow arches, formed a serious obstruction to the water traffic, more felt as this traffic has been more developed.

Speaking as architects, we may in the first place express our satisfaction that the new bridge is to be of masonry, and not an iron construction. Such a bridge is not only a finer and more monumental-looking object in itself than any form of iron girder bridge can be, but it is in reality far more enduring, and likely to last out the lives of a good many iron bridges. If the architectural treatment of the details is not particularly striking or original,—if the whole design is not, in its effect, all that some of us think a bridge might be made, even in accordance with the strictest engineering requirements, we may at least feel gratified that the structure is simple, solid, and unpretending, with no false display or striving after effect about it. In this respect it will be the most worthy companion to London and Waterloo bridges which has been erected of late years over the Thames, and is some compensation for the gewgaw sham Gothic of Blackfriars Bridge.

We take from the specification a few notes in regard to the plan and construction of the bridge. The approaches on each side are carried on brick arches with the spandrels filled up solid with concrete. The bridge itself is of granite; the skewbacks of abutments and piers to be composed of blocks of the form and dimensions shown, and not less than 4 ft. on the bed, measuring across the axis of the bridge; the voussoirs are the same minimum width. In setting the stones, vertical strips of lead $\frac{3}{16}$ in. thick, 2 in. wide, and the full depth of the stones in length, are inserted at a distance of 6 in. from each end of each stone, and as each course is completed the joints are filled in between the lead strips with Portland cement and sharp Thames sand (1 and 1).

The whole of the five arches are being carried on simultaneously, so that no arch is at any time more than one course in advance of another. The whole surface of the extrados and skewbacks, on completion, will be covered with Claridge's asphalte half an inch in thickness, and turned up 6 in. against the inner surface of the outer spandrel walls, the inner spandrel walls being then built of brick. A platform of Bradford landings 9 in. thick will then be laid over the whole. For the carriageway this will be surmounted by a layer of concrete, and on this the carriageway will be formed with granite sets. The foot platforms will be formed of 3-in. York stone flagging, and between this and the 6-in. Bradford landings will be laid the water-pipes which are now carried on an aqueduct parallel to the old bridge, allowing room for a future water-main to be laid eventually by the Chelsea waterworks company. The space round the pipes to be filled up with sand, on which the flags will be bedded. This is all clearly shown in the section of the bridge.

The cement used is Portland, of the best quality; the briquettes to stand a tensile strain of 170 lb. per square inch twenty-eight days after they are made. All lime is from the lower or hardened beds of blue lias formation. Cement concrete, one of cement to eight of ballast; lime concrete, one of lime to six of ballast. Concrete filling to be in layers of not more than 12 in., each layer to lie at least three days before the next is added.

In making the foundations iron caissons in two lengths, with a detachable but water-tight joint, have been used. The lower caisson, constructed with a cutting edge at the bottom, was principally to facilitate the excavation of soil, the upper one to shield the piers while building. The lower caissons, three to each pier (see smaller section drawing), consist of two skins of rolled wrought-iron plates, the outer skin $\frac{1}{4}$ in., the inner one $\frac{3}{16}$ in., with a space of 3 ft. 6 in. between them. As the caissons were separately lowered by four lowering screws to each caisson, their weight was increased by filling the space between the skins with concrete. When each caisson was on its final foundation level the cutting edges were underpinned with Bramley Fall stones, 4 ft. by 4 ft. by 2 ft. on a bed of 12 in. of concrete between the stones and the river clay, the caissons were gradually filled up internally with successive 12 in. layers of concrete level with their rims, and the brick-footing laid on this basis.

The arches are being turned on nine wrought-iron ribs to each arch, as shown on the drawings, the ironwork being specified to be "of as good and finished a quality as if it were intended for permanent work." The sight of these business-like girders has led some people to suppose the bridge was to be of iron construction; it is so referred to by Mr. Ernest George in the note to his etching of the old Battersea Bridge. He will probably be glad to find he is mistaken. The iron centres are carried, as will be seen, on a series of piled timber piers, which in themselves have formed no slight piece of work, the necessity of keeping an open waterway throwing some extra difficulty in the way. We give *verbatim* a part of the specification referring to this portion of the work:—

"When the eight piles are driven to their proper depth, they are to be securely cramped together with twenty wrought-iron timber dogs to each support, and are then to have their collars removed and the heads sawn off level, so as to give a perfectly true and even bearing to the cross head-piece, which is to be set true and carefully on each four piles, so as to distribute the weight uniformly on each single pile. All piles are to be shod with wrought-iron shoes, not less than 15 lb. each, and strong iron hoops also to the heads, the iron 4 in. broad by 1 in. thick. On the top of these cross heads, of which there are two to each support, is to be set the lower and upper sill, both of elm, and to be of carefully-selected timber, as between these sills are to be placed the wedges, and the 'bearing surfaces' between the wedges and that come on the cross heads must be adzed to a true and regular line so as to allow of the same thickness of wedges throughout, and the parts that are directly under the cast-iron bed-plate to be of one uniform level. When the lower sill is fixed in position and securely fastened with dogs, driven in the sides and to each cross head, the wedges are to be placed longitudinally with it, and care taken to have them fixed across the centre line of the girders. These wedges are to be of oak, selected timber fully seasoned, and are to be carefully sawn to the given form, and a template is to be submitted for the Engineer's approval before they are fixed. When the wedges are fixed the top sill is to be placed in position on the top of them, but care must be taken that the distance between the sills before the girders are fixed is not less than 1 ft., so as to have as little raising of the girders by the wedges as possible, and to have as much lowering space for the girders as can be obtained when the centres are 'struck.' Between the main support and the single pile that carries the end of the girder an intermediate set of piles or supports to be driven under the same conditions as those heretofore described, and in the same line, and to be dogged securely together. The single pile next to the masonry is to be placed upright in position and in the pocket left in the masonry, and the foot of the pile sawn off square, so as to allow of its having its full bearing on the concrete. When all the piles are fixed in their proper position, the 12 in. by 12 in. 'stringers' are to be fixed, care being taken that the faces or parts of timber that are in contact are to come close together to allow of their being bolted together with 1-in. wrought-iron bolts, with 4-in. square washers $\frac{3}{8}$ in. thick, and in no case any small packing or make-up pieces are to be used. In every alternate bay, or 11 ft. 4 in. apart, is to be fixed crossed single bracing 12 ft. by 6 ft. as shown, bolted securely to the top, and half-way down the piles, and fixed between the 12 ft. by 12 ft. stringers. The entire face of the 50-ft. opening are to be covered with 12 ft. by 6 ft. aling pieces, fixed 12 in. apart, and to be securely spiked to the main piles, and all corners or unevenness is to be adzed off, so as to enable a smooth passage to any craft going through the opening. When all the piles are driven, and all bracing or wallings are fixed complete, the girders A may be fixed or built in their places, namely 5 ft. 8 in. apart from centre to centre, care being taken that the cast-iron bed-plates come over the centre of the supports."

The approaches have been protected, as shown on the drawings, by "dolphins" consisting of five main piles, canting outwards from the 20-ft. waterway left under the centering, and by floating booms rising and falling in guides, with the tide. The ends only of these booms are seen on the drawing.

The contract includes the entire removal of old Putney Bridge, the materials of which are to become the property of the contractor.

It is expected that the new bridge will be completed within a year from this time.

The design of the bridge is by Sir J. Bazalgette, Chief Engineer to the Board of Works, and Mr. E. Bazalgette has had the immediate direction of the works. The contractor is Mr. John Waddell, of Edinburgh, and the amount of the contract is 244,000*l*.

## THE TOWER OF LONDON IN THE TIME OF ELIZABETH.

FOR descriptive article pertaining to this illustration, which has been drawn by Mr. H. W. Brewer, see p. 6.

## CALLENDAR HOUSE, STIRLINGSHIRE.

FOR a description of this notable old mansion, see p. 8.

**Paris International Exhibition, 1885.**—It is the intention of the Minister of Commerce to have exhibited a collection of teaching material and specimens of results from French schools. The Educational Section in Group V. (Classes 38 to 44) will comprise plans, models, &c., of schools and other institutions, teaching appliances, gymnastics, military exercises, and equipments, &c., printing and books, stationery, office furniture, photography, and musical instruments. In the scientific annexe will be included geology, ethnography, discoveries, instruments and apparatus for medicine, surgery, astronomy, geography, weights and measures, and money of different nations. The artistic annexe is to comprise paintings, sculpture, architectural models and designs, reproduction of ancient and modern monuments, paintings on enamel, porcelain, medals, &c., and the industrial arts. The London offices are at 1, Castle-street, Holborn, where applications for the remaining available space and all communications from British exhibitors should be addressed to Mr. Edmund Johnson, Commissaire Délégué.

## THE INSTITUTION OF CIVIL ENGINEERS.

IN conformity with the by-laws, the annual general meeting was held on the 23rd of December, "being the Tuesday previous to Christmas Eve," the President, Sir J. W. Bazalgette, C.B., in the chair.

In the report of the Council it was remarked that it might be convenient to take, as a starting-point, the condition of the Institution when the present by-laws were enacted on the 2nd of December, 1878. Then the strength consisted, irrespective of the students, of 2,815 of all other classes, now that number was 3,782, or an increase of 34 per cent. in six years. During the past session there had been 279 elections, while the deductions from deaths, resignations, and erasures, were 85, leaving a net effective increase of 194, or 5½ per cent. in the twelve months. Out of the elections 100 candidates were resident beyond the sea, a proof that engineers in the Colonies were well satisfied with the way in which the affairs of the Institution were conducted and administered.

The death of Mr. Charles Manby, who was for seventeen years the secretary, and had since 1856 been the honorary secretary, had removed from the books one who had taken for many years a leading part in the conduct of the affairs of the Institution. By his tact and energy at an early and critical period of its history, he had managed to secure the co-operation of the principal members of the profession, and of scientific men generally, and thus laid the foundation for its present reputation and success.

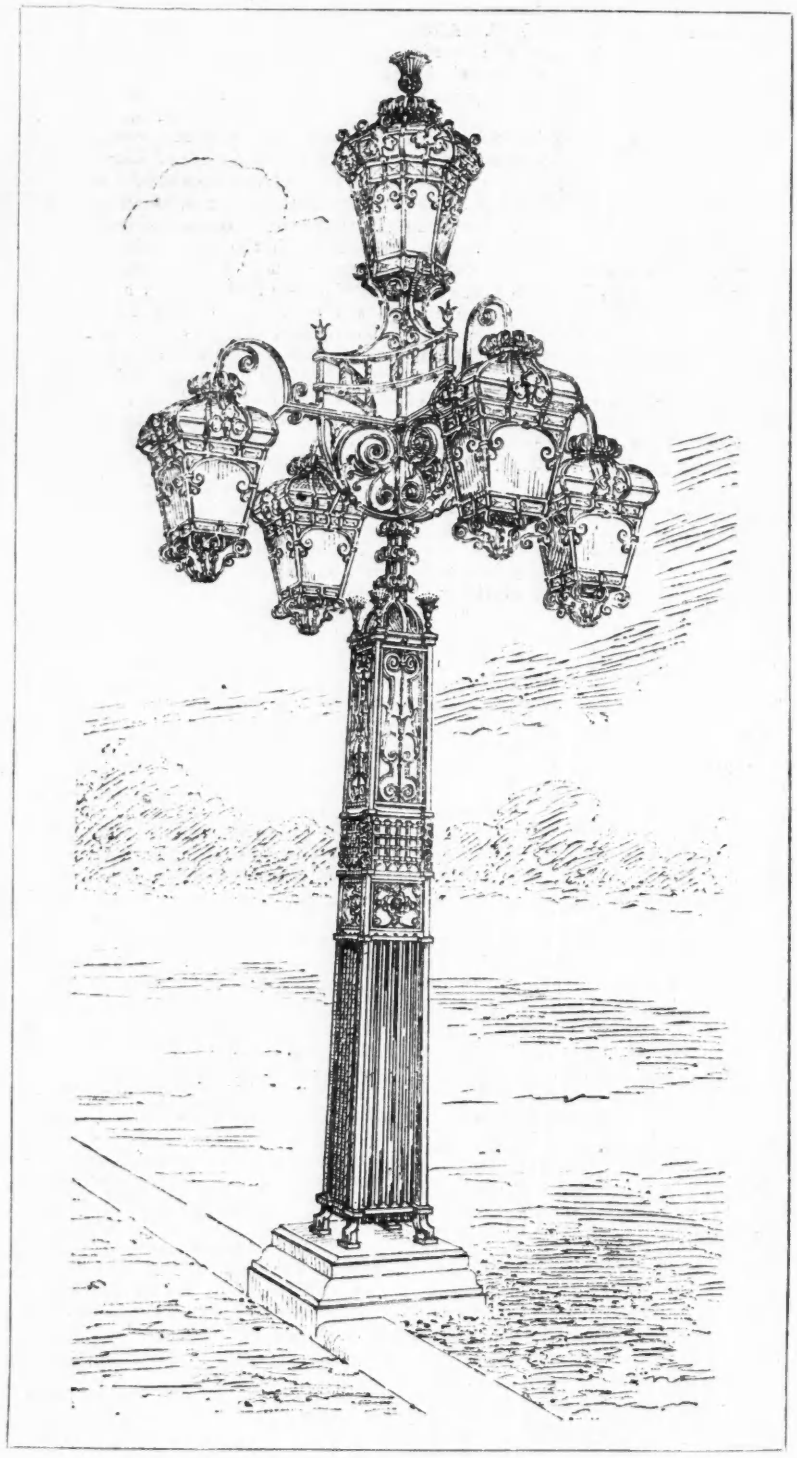
The changes in the class of students had been very numerous; for, although there were 170 admissions, exactly the same number had disappeared from the list, of whom 71 had become Associate Members. The total remained the same, 722, as at the close of last year. Of the 1,964 Students admitted since the creation of the class seventeen years ago, 48 were now Members, 545 Associate Members, and 6 Associates. As greater activity had of late been displayed by the students, the Council had sanctioned, as an experiment, the announcement of twelve meetings for Students only for the Session 1884-85, three before Christmas, and nine afterwards, at fortnightly intervals. No paper would, after the current session, be received from a student, in competition for the Miller Scholarship and the Miller Prizes, when he was qualified by age, viz., twenty-five years, for election into the Corporation.

As there seemed to be a strong desire, among many non-resident members, that the day for holding the Annual General Meeting should be altered, the out-going Council expressed the hope that its successor would see fit to convene a Special General Meeting, at an early and convenient date, for the purpose of considering the propriety, and, if approved, of making the necessary alteration in the By-laws to effect the change.

The statement of receipts and payments, for the year ended the 30th of November, showed that the income proper had amounted to 14,292*l.* 17s. 3d., of which 1,769*l.* 17s. 5d. arose from dividends on Institution investments, aggregating 48,000*l.*, and mainly placed in Debenture Stocks of British Railway Companies. There had also been received 3,495*l.* 9s. from life compositions and the admission fees of new members, which were treated as capital, and 432*l.* 11s. 2d. from dividends on Trust investments, the total of which was represented by 14,642*l.* 13s. 10d., almost entirely standing in Government Stocks. On the other side of the account, the general expenditure had been 12,476*l.* 18s. 5d., of which 6,193*l.* 15s. 5d. had been applied in the production of the publications, about 25,000 volumes in all, which were delivered free of charge to all members wherever resident. The capital investments during the year had amounted to 5,322*l.* 3s. 8d., and the premiums under trust had absorbed 516*l.* 11s. 11d.

The Council were directed to arrange for the publication of the papers read at the Ordinary Meetings, and of such other documents as might be calculated to advance professional knowledge, in aid of the public and scientific objects for which the Society was founded.

The ballot for Council for the ensuing year resulted in the election of Sir Frederick Bramwell, F.R.S., as President; of Mr. E. Woods, Mr. G. B. Bruce, Sir John Coode, and Mr. G. Berkley, as Vice-presidents; and of Mr. B. Baker, Mr. J. W. Barry, Sir Henry Bessemer, F.R.S., Mr. E. A. Cowper, Sir James N. Douglass, Mr. C. D. Fox, Mr. A. Giles, M.P., Mr. H. Hayter, Dr. W. Pole, F.R.S., Mr. W. H. Preece, F.R.S., Sir Robert Rawlinson, C.B., Sir E. J. Reed, K.C.B., P.R.S., M.P., Mr. F. C. Stileman, Sir William Thomson, F.R.S., and Sir Joseph Whitworth, bart., F.R.S., as other members of Council.



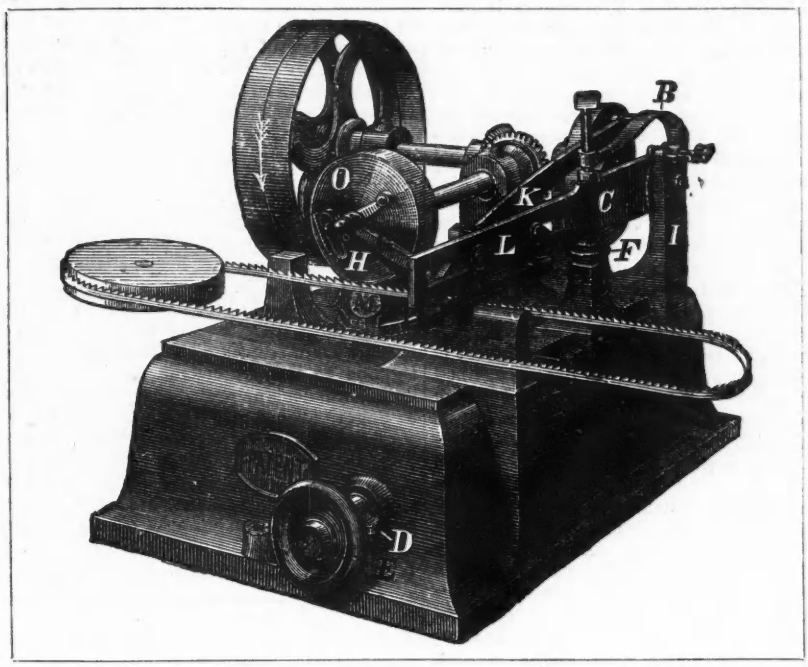
*Lamp-Standard, Eaton Hall.*

## WROUGHT-IRON LAMP STANDARD, EATON HALL.

THE standard is 30 ft. high. The panels are symbolical of the arms of the Grosvenor family, the portcullis with the attendant chains forming part of the ornament. The Tudor rose above is skilfully wrought out of sheet-iron enclosed in a frame-work. The column terminates with four arms. The lamps are surmounted by ducal strawberry leaves; the top terminates with a thistle, his Grace being a Knight of the Thistle. The lamps are supported by an elaborate spandrel. The weight of the whole fabric is over two tons, and is entirely of wronght-iron, and in no case has cast or malleable iron been introduced. The whole was designed by Mr. Fairfax B. Wade, and is one of a series now being erected on the terrace in front of Eaton Hall, Chester. The work has been carried out by Messrs. Alfred Newman & Co.

**Earthquakes in Spain.**—Accounts from the southern provinces represent the earthquake on Christmas Day as much more serious than it was at first reported. In many towns and villages of the provinces of Granada and Malaga buildings were completely razed to the ground, and many more damaged beyond repair. In the town of Albaquerques half the houses are said to be destroyed. The loss of life is considerable. A private letter from Malaga says that seven distinct shocks were felt in the town, the first being very severe and lasting quite fifteen seconds. The Government Commissioners, who have begun their visit to the rural districts, state that 192 bodies have been buried at Alhama. At Albunuelas 1,000 dwellings were destroyed. In the Academy of Arts, in Madrid, on Tuesday night, a report was read showing that the earthquake inflicted only slight damage upon the cathedrals at Seville and Granada, and that all other monuments escaped.

**Change of Address.**—Mr. A. Newman, some of whose work we illustrate in another column, has just removed his forge from Marlborough-mews to Archer-street, Haymarket, as he informs us by means of a characteristically Mediæval circular.




## A NEW BAND-SAW FILING MACHINE.

AN efficient band-saw filing machine has long been a want in the building and kindred trades, and this want appears to be fairly supplied in the very ingenious machine introduced to the public by Messrs. Selig, Sonnenthal, & Co., of Queen Victoria-street. It is an American invention, and it may be stated at once that the machine is not intended to supersede the file, but to use it with better effect, and with a saving in the cost of files, band-saws, and wages. Among its chief advantages, it files with an ordinary 5½ in. taper saw file, or with any other file of the same length suitable for the shape of the tooth. It can be worked by hand or steam power. It is easily adjustible to various widths of saw-blades, up to 2½ in., and to different pitches of teeth. It files eighty teeth per minute, doing the work regularly, and saving the tedious process of finishing the blades. The machine only occupies a small space, 16 in. by 22 in. In mounting or fixing it for use, it is screwed to a table, or down on an ordinary bench, wooden supports being placed on each side to guide the saw. To the left of the machine, revolving easily upon a fixed vertical spindle, a wooden disc is necessary to the support, the saw-blade running round the disc during the filing, and passing in its circuit transversely through the vice of the machine. The blade being adjusted in the vice, and the motive power applied, the file must commence to cut in the centre of the inclined or sloping part of the tooth, and, as it moves forward, is brought on to the upright or cutting edge. The principle of the cam is effectively applied, and the lifting action through which the file is raised and withdrawn after each filing operation, to be again instantly moved forward to its work, is singularly steady and regular.

By means of the accompanying illustration, the chief points of the machine may be clearly seen. Before fixing the blade in the vice, A, and commencing operations, the spring, B, in the movable arm, C, must be raised and turned slightly to the left, when the arm can be raised vertically. The thumbscrew, D, on the spindle of the hand-wheel, E, is next loosened and the hand-wheel turned so as to bring down the adjustable carriers in the vice. The blade is then pressed down between the vice and the spring on to the corners and the hand-wheel turned so that the teeth may be sufficiently protruded to allow the file to clear the vice, after which the thumbscrew is tightened up. The movable arm is rested upon the screw-head, F, which latter must be raised enough to keep the file from touching the saw. On to the blade the feed-pawl, G, is then dropped, its stroke being regulated by the graduated quadrant, H, to the length of about a tooth and a half to one revolution of the pulley. The screw holding the index-finger must be securely tightened, and the screw-head, F, lowered sufficiently to give the file the light or heavy cut required; then tighten when adjusted. When the file moves from the centre of the tooth and is brought forward in its action to the upright or cutting edge, the latter cut, if it be too heavy, is remedied by screwing up the front spring on Standard I. (if too light the back spring is screwed up), but not so tightly as to prevent the file after the cut from easily leaving the tooth. When the file is worn, or so far used up that it loses its bite, the spring, B, must be replaced on the movable arm and regulated by the screw. If it should occur that the file does not work easily against the upright edge of the tooth, it may be that the pawl makes too long a stroke, which can easily be shortened. It will be found while the file is sharp the weight of the arm is sufficient, unless the longer teeth of uneven blades are to be filed off quickly, but by keeping the arm upon the screw-head, F, the cut will be prevented from being irregular. It will be necessary to keep the journals of the machine well lubricated, including both ends of the eccentric rod, K, the sliding piece, L, the hole in the pawl, the pin in the small disc, M, and the eccentric, O.

In filing uneven blades, the machine should be adjusted for taking off the larger teeth first, passing the blade through several times, until it is found that the teeth are of uniform height; but new blades, or blades finished in the machine, are sharpened by passing through once.

On the whole, we are favourably impressed with the construction and working of the machine.

## EDINBURGH.

DR. ROWAND ANDERSON has completed the plans for the building to be erected in Queen-street for the joint accommodation of the National Portrait Gallery and the Museum of Antiquities, and they have been approved of. The design is carried out in the thirteenth-century Gothic style which the architect has adopted by considerations of utility as well as beauty, the style being one which readily adapts itself to the providing of sufficient window openings for such of the galleries as require to be lighted from the sides. The elevation is divided into three stories, the lower two of which are lighted by large pointed windows, the third story presenting a broad unpierced surface, the light of the third floor being entirely derived from the roof. The entrance is in the centre of the north front, and consists of a deeply-recessed pointed doorway, having a row of niches over it, above which appears a triplet window, the whole culminating in a gable. The piers between the windows of the first floor are formed into niches with pinnacled canopies, in which it is proposed to place life-size statues of celebrities. Provision is made in the design for future extensions in the form of wings, and alternative elevations of these proposed additions are shown, one having angle turrets at the four corners and the other without these features. A temporary structure of brick lined with wood is to be placed on part of the ground to be used as a place of exhibition pending the erection of the permanent galleries.

The Scottish admirers of the late Dean Stanley, desirous of showing their sympathy with the liberal and enlightened opinions of the Dean in regard to the civil and ecclesiastical history of Scotland, have arranged that a suitable memorial of him should be placed in St. Giles's Cathedral. This is to take the form of a mural tablet having as its principal feature a replica of the profile in bronze of the Dean which has been placed in St. George's Chapel, Windsor. The site of the memorial is in the south transept, adjoining the royal pew. Three new stained-glass windows are at present being placed in the south transept, and it has been found that the royal pew will obstruct the view of these. This pew originally stood facing the chancel, having at its back the bare, unpierced wall, which cut off the choir from the rest of the interior. It is much too cumbrous for its present position, and it is proposed to utilise it in forming a screen across the interior of the west doorway. A new pew, of a less ponderous description, will take its place, and this, like the original one, will be of oak, with appropriate carved decoration.

Two new police stations have been sanctioned, both of considerable dimensions. One of these, in the West Port, has been in hand for some time, and the other, in the Causewayside, will be commenced forthwith. They are both designed in Scottish Baronial style, by Mr. Robert Morham, city architect. Objection was made to the design of these buildings by a member of the Town Council, on the ground that they were ornamental, but one of the magistrates, who is himself a practical builder, said that the estimates for the buildings were very moderate, considering the amount of accommodation required; and the Lord Provost remarked that a public building should have some distinguishing mark, and that it would not be appropriate without ornamentation of some kind.

## BELL-RINGING.

SIR,—Having received my *Builder* to-day, as during twenty years past, I am greatly astounded at the "Note" anent church bells. On a recent occasion, in back issues, several letters appeared, relative to suggestions to "gentlemen ringers" about fifteen years back. It must not be forgotten that change-ringing is the only recreation for a great many young men, in large and small towns. In the country, the tower is generally in the hands of a set of sulky louts, who will neither learn the elements of the science nor let others more intelligent make the attempt to do so.

With respect to Kensington, the matter is perfectly remedial; as, in fact, everywhere else.

Let the architect provide shutters to the inside of the bell-chamber windows, and during ringing and heavy storms keep them all shut. During ringing, in this instance the sound will pass up the spire, and fall, *not* in the nearest windows, but half a mile distant.

Having applied this scheme to my own parish church, where the bells are heavy, and often practised, the residents round the church cannot hear the bells at all in their shops and private dwellings.

This has been also carried into effect at Sir G. Scott's cathedral in Edinburgh; with what effect I cannot say, but am informed that the disagreeable clang due to re-echo against near walls is entirely removed.

Surely it is far better to have a good ring in one place, such as an important parish church, than having bell-lovers like myself erecting light rings in their own dwellings, which result would certainly follow any legislation against church bells.

Greater nuisances than change-ringing require putting down, such as organ-grinding and piano-playing all night. The most the Kensington people have to put up with is but two hours in each week,—probably much less. The grand ring of ten at St. Clement Danes was never complained of by the patients in King's College Hospital; nor, as far as I know, any of the well-known bells round other hospitals.

FRANCIS GRAYLING, F.R.C.P.,
Member of the Ancient Society of College Youths.
*Sittingbourne, Dec.* 25.

## DR. JOHNSON'S HOUSE IN BOLT COURT.

SIR,—There is a slight inaccuracy in your number for Dec. 13 [p. 787] with reference to the Stationers' Company's School in Bolt-court and the house in which Dr. Johnson lived and died. I would point out that the school premises proper and the school-house or residence of the head-master (generally supposed to be Dr. Johnson's old house) are two distinct buildings, and of different dates. The former, which is quite a modern structure, of not more than twenty-five or twenty-six years old, was erected by the Stationers' Company expressly for their school; but the latter,—the school-house,—was purchased by them as it now stands, and is a much older structure altogether. It is a large old-fashioned residential building, and, from the general character of its architecture and its internal fittings, would seem to be of a date contemporary with Dr. Johnson. The house in which the Doctor died you state was completely destroyed by fire in 1819, which I am inclined to doubt, because that would make the present house which stands on its site not much more than sixty years old,—that is, supposing it to have been rebuilt immediately after the fire. But the house in question has all the appearance of being much older than that. From the size and number of the rooms, the thickness of the walls, the old-fashioned doors and window-shutters, &c., I should conclude that the old house was not so completely destroyed by fire as you state, but that, though greatly damaged, it was afterwards restored to much of its original condition, in which case the present school-house may fairly be considered as very nearly identical with the house in which the Doctor breathed his last.

With regard to the numbering of the houses, there has evidently been at some time an alteration in the houses in the court, and a little confusion has been thus introduced into the numbers, which I am not in any way able to elucidate.

F. HOWARD,
Assistant Master, Stationers' School.

*** We fail to discover what inaccuracy Mr. Howard would correct. The facts are as stated. As to No. 6, Bolt-court, there is certainly one room,—the class-room on the ground-floor to the left,—which has an eighteenth-century air. We find nothing else to warrant Mr. Howard's conclusion as to the age of the interior, which, however, is substantial and old-fashioned. Then as to No. 8, Bolt-court, contrasting the now house from without with,—

(*a*) The coloured drawing, signed and dated "C. Tomkins, 1801," in vol. viii., Crowle Pennant, showing a dark brick house with red brick voussoirs over windows;
(*b*) The view of 1810 (G. Shepherd, delin.; S. Rawles, sculpt.) in the Crace Collection, British Museum;
(*c*) The view in Soane Museum; and
(*d*) The view by C. J. Smith in vol. vii., Croker's "Boswell," Bohn, 1848,—

it will appear how the front elevation,—alike in those,—differs from the present; and strikingly in that the central line windows which light the staircase in the existing house are upon a different level from the other windows, and have deep round-headed reveals.

Moreover, conclusive proof of what we said will be found in *All the Year Round* for the 9th of July, 1859. Therein is quoted a passage supplied to Dickens by Mr. Bensley, son and successor to the Bensley who succeeded Sam. Richardson and Allen, Johnson's friend. Born in Johnson's house, Bensley lived there, and in the house which replaced it after the fire of 1819 until the sale to the Stationers' Company, 1858. He says, *inter alia*, that the fire totally consumed Johnson's residence.

Cassell's "Old and New London" makes a hash of the whole thing, vol. i., pp. 112-13. Thornbury's blunders (for he, we believe, wrote the earlier part of that work) are crowned by the illustration. This, professedly "No. 8," is in reality No. 3, a house on the eastern side of the court, which has always belonged to the Medical Society of London (lately removed to Chandos-street, W.), and where until lately their meetings were held. The original rooms are now occupied by Mr. Parkes, a surgeon. The house is distinguished by the figured medallion over the door, once gilt. It is a much older house than No. 6, the Stationers' School-house.

It may be added that in the *Builder* for Sept. 12, 1857, there were given views of Dr. Johnson's chambers in Hare-court and Inner Temple-lane.

## RATES IN THE INNS OF COURT.

SIR,—In your "Notes" of last week [p. 849] I observe a statement is put forth that the Inns of Court and some other Inns are exempted from any payment of local rates, being themselves extra-parochial. So far as regards one of the places mentioned, viz., Gray's Inn, I for one can speak quite feelingly to the contrary, having myself contributed as lessee and occupier of a set of chambers in this Inn,—year by year for nearly ten years past,—my quota to the Poor, School Board, and other rates, which are duly made and levied by the constituted authorities at least twice a year.

LEONARD F. CLOW.

## PROVINCIAL NEWS.

*Bristol.*—The extensive factory which the well-known firm of Messrs. W. D. and H. O. Wills, tobacco manufacturers, of Redcliff-street, are about to erect in East-street, Bedminster, has been commenced, and the work is now in full operation. The site is that formerly occupied by Rake's tannery, and the building when erected will be one of the largest tobacco factories in the country. It will have a frontage to East-street of 260 ft., and a depth of 295 ft. The front elevation will be Gothic in character, and the materials used will be Cattybrook faced bricks, with freestone dressings. Mr. Frank Wills is the architect, and the general building contract has been let to Mr. A. J. Beaven, of Bedminster, and Mr. Henry Sampson, also of Bedminster, is the contractor for the iron-work and fire-proof floors, the amount of their joint tender being 27,000*l.*

*Boston.*—On the 15th ult. a new dock was opered at Boston, Lincolnshire. The dock, which is situate near to the town and close to the people's Park, is 825 ft. long and 450 ft. wide, the water area being upwards of seven acres. The lock is 300 ft. long and 50 ft. wide, having two pairs of gates. The walls of the dock are vertical, 32 ft. 6 in. high from floor to coping, and 15 ft. thick at the base, built of concrete, the upper part, where the ships come in contact with the walls, being lined with Staffordshire blue bricks. The coping is hard sandstone. The dock is connected with the Great Northern Railway by a swing bridge across the haven of the river Witham, and the quays are provided with sidings in connexion with the railway. There are capacious granaries for storing purposes, travelling cranes, large fixed cranes, &c. A coal hoist, worked by hydraulic power, and capable of filling a ship of a thousand tons during one tide, has been erected on one of the quays. The hoist is capable of discharging either drop, bottom, or end delivery trucks, and is so arranged as to deliver the coal with as little breakage as possible. The foundation of the lock is composed of cement concrete, and rests on a bed of very hard clay. The invert is of sandstone, and the walls of concrete, lined with Staffordshire bricks. The sills and hollow quoins are of granite. The lock gates are of pitch-pine, with greenheart heel-posts, mitre-posts, and bottom ribs. Each gate is 29 ft. 6 in. long, 32 ft. high, and 2 ft. 7 in. thick. The sluices are disposed in the side walls, and so arranged as to scour the mud from the back of the gates and lock pits. A wooden pier extends from the mouth of the lock to the channel with bollards, and there are other conveniences for getting vessels in and out. A jetty extends from the lock wall along the river parallel with the dock, with landing-stages, steps, and sidings to the railway. The swing-bridge is of wrought iron, 126 ft. long and 13 ft. wide. It swings on an oval-shaped cast-iron pier sunk in the middle of the river. It is expected that a large coal import trade will take place from Boston, which is now by far the nearest port to the collieries of Nottingham and South Yorkshire, and also the nearest port for the great commercial centres of the midland counties. Arrangements have already been made for a large import timber trade from the Baltic, a considerable portion of the dock quays having already been taken for storing. The port will be useful for fishing-smack purposes, and a large fishing trade is anticipated. The cost of the dock, including hydraulic power, warehouses, &c., has been about 120,000*l.* The plans for the dock were prepared by Mr. W. H. Wheeler, C.E., the borough engineer, and the consulting engineer has been Mr. J. Abernethy, Past-President of the Society of Engineers. The improvement of the outfall has been recently completed at a cost of 100,000*l.*, a new channel having been cut through the clays at the mouth of the Witham.——On the following day a new iron railway bridge, 300 ft. long, crossing the Witham near the Grand Sluice at Boston, was tested and opened for traffic. The bridge, which has cost from 12,000*l.* to 14,000*l.*, has been constructed by Mr. Matthew Pitts, of Leeds, from designs by Mr. Richard Johnson, chief engineer of the Great Northern Railway, and carried out under the supervision of Mr. Charles Kirby, district engineer. It crosses the river in three spans. The central supports are six cylinders, sunk 25 ft. below the bed of the river, and brick abutments resting on piles form the end supports.

*Leicester.*—A new hosiery factory, which has been taken by Messrs. I. & R. Morley, has just been erected by Mr. Thomas Jones. The builder was Mr. Harry Bland, of Oxford-street, Leicester. The new building, a lofty structure of three storeys, occupies a site opposite the Board schools and chapel, covering an area of about 1,200 yards. The basement is fitted up as a "strong room," 110 ft. by 42 ft., for the storage of yarn and manufactured goods. At the rear of the warehouse stands the ground-floor factory, 110 ft. by 42 ft. and the engine room, containing two 30-h.p. boilers by Hawksley, Wild, & Co., of Sheffield, and a ponderous engine by Mr. T. Bates, of Sowerby Bridge, Lancashire. Connected with the boiler-house is a chimney, the dimensions of which are, height 120 ft., diameter at base 11 ft., and at summit 5 ft. The chimney stands upon a foundation of fifty tons of stone, and is constructed of pressed Coalville bricks, with blue brick angles. The cap is a speciality, being designed in pressed brick relieved with Derbyshire stone; it is altogether devoid of projections. The first floor is divided into warehouse and factory, the former 64 ft. by 32 ft., and the latter 120 ft. by 43 ft. Each department is fitted with separate lavatories, &c., in fact, this remark applies to the whole building. The second and third storeys are also devoted to a factory and warehouse upon each floor. The rooms are lofty, and ventilation is obtained by means of forty Tobin shafts, in connexion with which are a number of extraction tubes. The rooms are heated by steam apparatus supplied by Mr. F. Ashwell, Leicester. Externally the building is in the Elizabethan style. The following are the sub-contractors:—For plumbing and glazing, Messrs. Norman and Underwood, Freeschool-lane; iron-work, Messrs. Gimson and Co., Vulcan-street; plastering, Mr. T. Nicholls, Crafton-street.——The Walker Memorial Hall, erected on the Highfields by Messrs. Walker, hosiery manufacturers, Rutland-street, in memory of their father, the late Mr. Robert Walker, was opened on the 20th ult. The edifice occupies a commanding site fronting the Melbourne-road, contiguous to the Melbourne Hall. It has been built from designs prepared by Messrs. Goddard & Paget, architects, and is composed of red sand bricks. On the ground-floor is a spacious hall, 45 feet by 44 feet, flanked by two large class-rooms. The class-room adjacent to the front entrance is fitted up as a coffee and reading room. The contractor for the work was Mr. Bentley, and the sub-contractor for the brickwork, Mr. Butteriss.

## CHURCH BUILDING NEWS.

*Alcester.*—The chancel of Arrow Church has received an addition in the shape of an elaborate reredos in polished alabaster. It is given by the Dowager Marchioness in memory of the late Marquis of Hertford, K.G. It extends the whole width of the east wall. In the centre, under a traceried and crocketted canopy, is the Cross in bold relief, on a diapered background, enclosed by buttresses supporting angels. On either side are double arches containing emblems of the four Evangelists, and at each of the ends are other arches filled with carvings of the wheat and vine, also divided by buttresses carrying angels, between which are gabled canopies enclosing the pelican and young and the Agnus Dei. All the arches are supported by marble columns, affording an agreeable contrast to the alabaster. The work has been executed by Messrs. Earp, Son, & Hobbs, of London and Manchester.

*Deane* (*Lancashire*).—The ancient church of St. Mary, in the hamlet and manor of Deane, near the growing town of Bolton, was re-opened on the 22nd ult., after having undergone repair. In 1833, when the late Canon Girdlestone was vicar of the parish, the serious state of decay into which portions of the edifice had fallen rendered considerable restoration necessary. This work was carried out in such a manner as to cover and completely hide many of the most striking features of the interior. The work of restoration now completed has been, so far as it had gone, of a thorough character. The new roof is an exact reproduction of the original roof, with the exception that the panels, instead of being filled in with plaster, are of oak boarding. The pillars and arches, which had been badly cut and notched in many places for the insertion of the gallery beams, have been repaired so far as was required for stability, without interfering with the ancient appearance of the stonework. The galleries have been removed. The arch in the tower at the west end has been opened out, and the tower fresh fitted for the bell ringers. The removal of the old staircases leading to the galleries has very much improved the appearance of the interior of the church, besides adding to the accommodation on the ground floor. The chancel has been lengthened some 10 ft., allowing room for the erection of choir stalls. In the extension of the chancel the old work has been carefully copied, old stone having been used, as far as possible, so as to avoid any appearance of patching; and in design the extension harmonises with the rest of the building. In taking down the east end the remains of earlier windows were found embedded in the wall under the late east window, and in the reconstruction the exact lines of the former window have been retained, and the detail enriched in accordance with the portions of the older window found. In removing the plaster on the side walls of the chancel, the old aumbry was found, and on both sides were traces of black letter inscriptions and coloured decorations,—about 4 ft. by 3 ft.,—enclosed in ornamental illuminated scroll-work. The fixing of the new roof and other principal work has been executed by Messrs. John Statham & Sons, of Pendleton. The

stonework has been carried out under the direction of that firm by Mr. James Bowden, of Pike's-lane. The oakwork in the Hulton "pew" is by Mr. James Hatch, of Lancaster. The whole of the work of restoration has been carried out under the direction of Mr. R. K. Freeman, architect, of Bolton.

*Eastbourne.*—Some decorative work is just being completed in the apse and sanctuary of this church. The ornamentation is wholly Byzantine in style, the ruling principle throughout being that the architectutal structure is everywhere closely followed and emphasised, the aim being to decorate the stonework, and preserve its texture, even when coloured, and broad spaces of the original stone are purposely left untouched between the decorated portions. The general features of the system of decoration adopted are as follow:—A double background to all colours, either absolute gold or gold colour, with white upon the gold before receiving the figures, or *vice versâ*. The patterns are chiefly conventional forms of flowers and foliage, wrought into panels, or formed into flowing bands following the architectural lines. The general design is due to Mr. Alfred Strong, architect of the church, and the work has been carried out by Mr. George Howe, of Wigmore-street, Cavendish-square.

*Wigan.*—A reredos, designed by Mr. A. E. Street, has just been erected in St. Michael's Church, Wigan. It is in three divisions, occupying the whole extent of the east wall. The central portion has a wide crocketted gable of Irish green marble, inclosing three arches, the centre one containing the sculpture of the Crucifixion, with the figures of the Virgin and St. John, and the arches on either side the figures of Saints Michael and Gabriel, all executed in white alabaster on a diapered background, the moulded jambs and mullions and plinth dividing them being of Greek red marble, with bands of black marble. Under them and above the super altar is a panelled dado of Irish green marble, pierced by quatrefoils inlaid with coloured marbles, the whole resting on a solid moulded thick slab of Isle of Man black marble on a wall of alabaster. The two end divisions are panelled with a moulded and inlaid framework of polished alabaster, having in its divisions sets of Garrard's embossed and enamelled tiles, the moulded plinths and cappings being of Isle of Man black marble. The wall above and around the east window is richly treated with mural decoration. This work has been executed by Messrs. Earp, Son, & Hobbs.

*Hampstead.*—The interior of Hampstead Old Church (St. John's) has just been enriched by a marble font, designed and presented by Mr. Alfred Bell, one of the Churchwardens. A cover of appropriate design is about to follow. Mr. Forsyth, of Finchley-road, Hampstead, was the sculptor.

*London.*—An elaborate wrought-iron chancel screen was added to St. Saviour's Church, St. George's-square, Belgravia, on Christmas Day. The work was executed by Mr. Barford, of Maidenhead, from the designs of Messrs. Romaine-Walker & Tanner, architects, of Buckingham-street, Adelphi.

## DISSENTING CHURCH-BUILDING NEWS.

*Leek.*—A new Primitive Methodist Chapel and Schools have been opened here. On the ground-floor is a schoolroom 34 ft. square, with six convenient class-rooms abutting upon it and divided off by glazed screens, with separate yards for boys and girls. There is an additional class-room in the tower, and there is abundant room for some 350 to 400 scholars. The first floor, which is used as the chapel, is 52 ft. by 35 ft. This has a gallery at the eastern end. The opposite end is occupied by a rostrum. Haden's warm fresh-air apparatus is used for this apartment. There is a vestry, with private stair, which can upon occasion be thrown into the chapel as a kind of small transept. Exclusive of this the total sittings are about 330 in the area, and some 70 more in the gallery. The works have been carried out by Messrs. Sugden & Son, architects. The builders were Mr. Herbert Hall, Mr. William Knowles, and Mr. Isaac Heath.

**Water Supply, Andover.**—Messrs. C. Isler & Co., of Southwark-street, have received orders to deepen the existing well for the supply of the town of Andover by means of a 15-inch artesian-bored tube well.

## SCHOOL-BUILDING NEWS.

*Croydon.*—Extensive alterations and additions have lately been made to the Brighton-road Board Schools, from plans by Mr. Robert Ridge, the architect and surveyor to the Board. The largest, and perhaps the most complete, addition is to the senior boys' department, approached at the western end by a flight of stone steps, leading to a large lobby, which gives access to the cloak-rooms, lavatories, and also direct to the boys' main schools and class-rooms. The desks in the principal boys' room are Lascelles's dual desks, the back rows being on raised platforms. Generally, Doulton's patent automatic flushing-tanks and stoneware ranges have been adopted for the latrines. The whole of the work has been carried out by Mr. W. Marriage, of the Oval, Croydon.

*Bristol.*—New Sunday Schools are being erected in connexion with Hebron Chapel, Bedminster, Bristol, from designs prepared by Mr. A. Slaughter, honorary architect, and they will shortly be completed. The work is being carried out by Mr. A. J. Beaven, of Bristol, the cost being 2,500*l.*

# The Student's Column.

## LIME, CEMENT, AND THEIR USES.—I.

IT will be evident that irrespective of the quality and strength of the stone or bricks to be used in the construction of a building, the mortar which unites them will exert considerable influence in the strength and permanency of the whole structure. Too much importance, therefore, cannot be attached to the selection of the materials, cement or lime and sand, of which the mortar is composed, and to the manner in which the mortar is compounded and used.

To enable a proper and judicious choice of materials being made it is essential that, at all events, a rudimentary knowledge should be possessed of the component parts of each; for it is impossible to make choice of a material of which nothing but its outward appearance is known. The very slight knowledge of weaving, for instance, possessed by the generality of people enables an opinion to be at once formed as to whether a piece of material is of properly woven thread or is what is generally termed "shoddy," so a slight knowledge of the components of a cement or lime, and of their manufacture, may assist in enabling a just opinion to be formed as to whether the sample under consideration is a good honest, material, capable of giving good results under proper treatment, or is worthless as a material for construction.

All cements used in building from the earliest ages have lime as a base combined with silica and alumina in varying proportions, or are what, for practical purposes, may be considered pure limes.

The limes have been divided by Vicat into five classes, and as the classification satisfies the distinctive qualities of each in a very perfect manner, there seems no reason why it should be disturbed. He classifies them as follows:—

No. 1. The rich limes.
No. 2. The poor limes.
No. 3. The slightly hydraulic limes.
No. 4. The hydraulic limes.
No. 5. The eminently hydraulic limes.

The eminently hydraulic, the hydraulic, and the slightly hydraulic limes are those which set more or less freely in water.

These are all produced by the simple calcination of limestones, containing different proportions of lime, silica, and alumina, in a state of chemical or only mechanical combination. Thus, the rich limes, or what are often called fat limes, are produced from the simple calcination of limestone, which is, for practical purposes, a pure carbonate of lime, such as a good white chalk. The poor lime is the result of calcining a limestone which contains a larger or smaller proportion of inert material; that is, silica in the form of sand, or other materials, which are only combined mechanically with the base of carbonate of lime. Coming, then, to the hydraulic limes, they are produced from limestones which contain silica and alumina in varying proportions in actual chemical combination with the base; the slightly hydraulic having but a small percentage of silica and alumina, while the eminently hydraulic may have as much as 20 per cent. of the two. For instance, the slightly hydraulic lime would be produced by the calcination of the grey chalk, and the eminently hydraulic from the limestone in the blue lias formation. In addition to the above, there is the lime produced from the dolomites or magnesium limestones.

The process of manufacture or the burning of lime is simple. The limestone, reduced to pieces of convenient size, is placed in alternate layers with coal in kilns and burned. The chemical action resulting from the calcination is the expulsion of the carbonic acid from the limestone, resulting in the production of quick-lime; this, again, has to be converted into a hydrate of lime by the addition of water when required for use. The proper methods of doing this will be described later on.

Cement, or what is known as Portland cement, has also, as has been already said, a base of lime, but contains a considerably larger percentage of silica and alumina in chemical combination with the base than any of the limes, and the calcination is carried out at a much higher temperature. The manufacture of cement is, further, not of such a simple character as that of lime. It is seldom that in nature a limestone is found that possesses the exact proportions of lime, silica, and alumina, for the production of Portland cement. The desired combination has, therefore, to be produced artificially by mixing materials which contain the required ingredients. This is generally attained by incorporating with a limestone a clay which contains the silica and alumina in proper proportions.

Portland cement may be produced from any raw materials which contain the requisite proportion of each ingredient. Some, however, are, of course, more easily treated and manipulated than others; while, for purely commercial reasons, it would be impossible to use some of them.

Chalk and clay are the materials which lend themselves most readily to manipulation. A description of the manner in which they are treated for the production of Portland cement will give a very general idea of some of the difficulties attending its manufacture, and enable just conclusions to be formed as to the causes of peculiarities which may be developed in any samples under consideration, or in any cement that may be used.

The chemical properties of the chalk and clay which the manufacturer uses having been determined, they are mechanically mixed with the addition of water in a wash-mill,—the resulting slip, or, as it is technically called, "slurry," passes through a sieve as it leaves the wash-mill, and is then, according to the most advanced process of manufacture, passed through mill-stones, and ground. From the mill-stones it is either pumped or run by gravitation on to large floors (under which are arranged flues), and dried. When all the moisture has been expelled, it is loaded into the kilns in alternate layers with coke, and burned. The resulting clinker, which should be dark in colour, and calcined almost to vitrefaction, is then broken into pieces the size of walnuts, and ground in mill-stones to the desired fineness; the result being the Portland cement of commerce. Thus the difficulties of manufacture will be appreciated. An error in the mixture of the due proportion of the raw materials, or in their proper and perfect mechanical admixture, or an error in the calcination, will result in a more or less imperfect cement, which, when used, will give indifferent or absolutely bad results.

The limits within which the chemical analysis of a Portland cement may vary is but small, not more than about five per cent. in the quantity of lime, and even this small difference, though not of itself sufficient to render a cement unsound, will make a cement either slow or quick setting, according to whether it contains the maximum or the minimum quantity. The amount of calcination to which a cement has been subjected will also, within certain limits, render it slow or quick setting, according as it has been hard or light burned.

Though theoretically a cement as it leaves the mill-stones is fit to use, practically it should be warehoused for some time, and allowed to cool before it is used. Theory and practice are often at variance without any assignable cause; but in this case the cause is easy to determine if the action which takes place by calcination is examined. Unlike the limestones, which by calcination are only deprived of their carbonic acid, the calcination of a raw cement effects in addition to the expulsion of the carbonic

acid, the chemical combination of the lime, silica, and alumina, which previously were only in a state of intimate mechanical admixture. If, therefore, this chemical combination has not been absolutely perfected, and except in a laboratory this is practically impossible, there will remain in the cement a small percentage (it may be only one or two per cent.) of lime which, though deprived of its carbonic acid, has not entered into chemical combination with the silica and alumina, and which remains, therefore, in a state of quicklime; and the action of adding water to it in this condition would cause it to expand, which, it is needless to say, would be detrimental to any work in which it was used. The object gained, therefore, by allowing a cement to be warehoused for a considerable time is to allow these small particles of free lime to "air slack,"—that is, to abstract carbonic acid from the atmosphere, and become so many inert particles in the cement. The presence of a small percentage of inert air-slacked lime is not detrimental to a cement; but of necessity the presence of free lime in any large quantity would render it, when fresh, very dangerous to use; and when aged, the presence of this inert lime would become an adulterant, and proportionately reduce its strength.

Given that the cement is properly proportioned and calcinated, the finer it is ground the better will be the result obtained with it in practice. There are, however, certain limits which it is not possible for the manufacturer to exceed economically, *i.e.*, it is more economical to use a larger proportion of cement than pay the manufacturer the extra cost necessitated by finer grinding; the economical point is attained when a cement will, when sifted through a sieve having fifty holes to the lineal inch (2,500 to the square inch) leave a residue on the sieve of only 10 per cent. This degree of fineness is sufficient for almost any purpose for which cement is used.

A cement may be slow or quick-setting according to the purpose for which it is required. The quick-setting cements attain great strength in a short time, but afterwards do not improve much, while the slower-setting, though longer in developing their strength, continue to improve for a long period, and ultimately attain greater strength than the quick-setting ones. A cement should carry at least 175 lb. per square inch when three days old, and should show an increase of at least 50 per cent. when seven days old, but the minimum strength at seven days should be 350 lb. A slow-setting cement will generally increase more than this, but at the seven days a quick-setting cement will generally be stronger than a slow-setting one. A cement is quick setting when it sets in less than an hour; a slow-setting cement will take five or more hours to attain the same hardness. Cements that take from one to five hours to set are comparatively more or less quick or slow setting. The time which a cement takes to set is determined by the time elapsing between the time of gauging it with water and until it will resist the pressure of the thumb-nail.

The quality of a cement is determined by

1. Its fineness.
2. The time it takes to set.
3. Its tensile strength at the expiration of three and seven days from gauging.
4. Its freedom from either expansion or contraction, or, in other words, its soundness.

To carry out a cement test satisfactorily, a considerable amount of skill, and, above all, of experience, is required. It is very easy indeed to obtain false results, more especially in testing the tensile strength; and as a false result means a comparatively bad one,—a test, unless carried out by an experienced person, may mean the condemnation of a really good material, resulting in disputes, reference to arbitrators, perhaps to legal proceedings, and, at all events, to much unpleasantness. The general instructions which follow for carrying out a cement test are given, therefore, not for the purpose of enabling the user to carry out his own tests,—which, by the way, he could not do without the necessary plant,—but to enable him to have sufficient knowledge to direct the manner in which a test should be carried out, and to enable him to draw up a specification which shall coincide with his requirements and the capabilities of a cement. It is worse than useless to draw up a specification which cannot be complied with.

On all important works the cement should be tested before being used, not after it has been put in the work. It is more satisfactory, and fairer to the manufacturer to know that the cement he is supplying is approved of or rejected before the complication of claims for labour expended and for pulling down and loss of time can have arisen; and it is certainly equally satisfactory to the user to know that the cement he is going to use is of the desired quality, and that he is certain of obtaining good work, if only the manipulation is carried out properly.

The fineness, time of setting, and soundness of a cement are absolute properties. The tensile strength is varying within certain limits, according to the skill of the operator in making the test blocks, but it must be understood that in testing the tensile strength, the object is to obtain the very best results possible.

The sample for testing should not be all taken from one sack, but from at least half a dozen, and well mixed before commencing the test. The fineness should be first ascertained by weighing out a certain quantity, say 25 ounces, or 12½ ounces. It is best to reckon by ounces and to take either of these quantities, because, in the first instance, ¼ ounce, and in the latter case, ⅛ ounce, is equal to 1 per cent. Having weighed out the cement, and placed it in the sieve of the proper mesh (50 by 50), it must be sifted through until nothing more will pass, when what is left in the sieve must be weighed, and the percentage at once determined. This experiment should be carried out twice, with different portions of cement, in order to ensure accuracy, and to be certain that a fair sample of the cement has been taken, and if there is any serious discrepancy in the results, a third experiment must be made.

## Books.

*Russian Art.* By ALFRED MASKELL. London: Chapman & Hall.

THE above work, published for the Committee and Council on Education, forms one of an excellent series of handbooks to the art treasures preserved in the South Kensington Museum. Its main object is to supply a guide to the reproductions of Russian works of art belonging to the Museum; but it includes a general survey of Russian art. The writer has a competent personal knowledge of the subject, and a wide acquaintance with its literature in the several European languages, and in his acknowledgment of obligations to other writers makes special mention of the *Art Russe*, of that prolific author and incomparable artist, the late M. Viollet-le-Duc. The first part of the book is devoted to a description,—with appropriate commentaries,—of the numerous art objects in the Russian Collections at St. Petersburg and Moscow, with interesting accounts of the circumstances attending the various "finds" at Kertch, Novo-Tcherkask, and elsewhere. The second part takes up the subject of religious art in Russia, and enters at length into the architecture and sacred vessels, ornaments, and decorations of Russian churches. A separate section of the work deals with arms and armour, and another on the collections of English and other plate in the Russian Imperial palaces. The whole is copiously and carefully illustrated. We have rarely met with a more interesting handbook. It is written with a full acquaintance with the subject, and in style is both concise and lucid; and it is a pleasure to be able to congratulate the author, without reserve, upon the accomplishment of what has evidently been to him a congenial task.

The Oriental character of Early Russian art is brought prominently forward, and the art of Russia, though possessing an unmistakable character of its own, is shown to be the result of the influence of every nation on earth. "We know for certain that in the earliest days of Russian art foreign artists and workmen abounded. They came from India, Persia, Byzantium. Lombard architects came to build churches, and not only Germans, Poles, and Hungarians poured in, but also French and English." Although the bulk of the art objects found in the various tombs are undoubtedly of high antiquity, their exact or even approximate date is almost always more or less problematical. Inscriptions are extremely rare indeed, almost unknown, and thus one valuable aid in the determination of age is wanting. In the very few cases in which any inscribed words are forthcoming, they unfortunately add perplexity to what was sufficiently doubtful before. A remarkable instance of this is given in the case of a cup in the collection of Count Ouvaroff, at Moscow. It was discovered in 1864, by a mere accident, and on its lip, amongst a series of dotted letters, the well-known Christian symbol ☧ occurs. The question of date was submitted to the Vatican, and Cardinal Pitra laid it before the Academy at Rome. Opinions were varied, and the cup was severally referred to a period three or four centuries before Christ, and to the fourth or fifth century of the Christian era. The Moscow *savants* were of opinion that the symbols simply declared the weight of the cup, and the balance of opinion was on their side. The conservative nature of the Christian art of the Russian Church is noteworthy. For eight hundred years it has maintained the same character in the disposition of its churches and their decoration, and in its ritual and symbolism. "There is but one school and one epoch. The artist does not create, but reproduce; and the painter knows but one costume for all times and places." Everything is fixed by tradition. The remarks upon Russian iconography are of the deepest interest, and this branch of his subject is treated by Mr. Maskell at considerable length. Those whose business it was to make works of art for religious purposes were enjoined to be "godly, steady, and not given to laughing,—not a thief, nor a murderer." He was to be pure in body and soul, to fast and pray, and then he might hope to find the grace of God, and be clever in his work. "If a disciple paint badly, the master is to be reprimanded" and the pupil is not to meddle any more with what is above his reach. If a teacher hide his art from his disciples "he shall be tortured in hell-fire, as was done to him who hid the talent." If, moreover, a painter paint badly or not according to the given model, or if he shall live impurely, he must be made to give up icon-painting, as there are other trades for such as he. The precision with which the given model was fixed is very singular,—some saints having always white faces, others green, and so on. The Black Madonnas of the Greek Church are known to everybody. But notwithstanding the efforts which have been made to preserve the ecclesiastical art of Russia from innovation, Western progress and Western ideas have made their mark. Stained glass from Munich has found its way into the modern churches, and even sculptured figures and groups are tolerated. We have only one suggestion to make by way of improving this manual,—the marginal addition of dates. The work is supposed to have been framed as a guide to the curious public as well as for students who have a more or less close acquaintance with Russian art. Much of the interest of the objects exhibited hinges upon their remote antiquity, and to the ordinary visitor it is not of much use to be told that a silver bowl is "of the epoch of the Persian dynasty of the Sassanians." With this hint at a possible improvement we have nothing but praise for Mr. Maskell's "Russian Art."

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*A Treatise on Steam Boiler Incrustation, &c.* By CHARLES THOMAS DAVIS. London: Sampson Low, Marston, & Co.

THE necessity for preventing corrosion in steam-boilers has long been under the consideration of engineers, and we can hardly agree with Mr. Davis in his view that it is a subject which has received but little attention in comparison with its importance, for, in his present work, he has taken great pains to describe several inventions for which patents have been taken out; and enumerates no less than ninety compositions for preventing and loosening incrustation, besides 150 mechanical appliances for removing the same. But Mr. Davis's present contribution conveys additional and valuable hints on the subject, and, as he truly observes, many boiler accidents which are are often described in the newspapers as "mysterious" could often be fully explained in the two words "natural results." Corrosion, which is the most common agent in promoting explosions, is frequently hastened by culpable negligence or ignorance in exposing the boiler plate unnecessarily to action which causes a wasting away of the iron; and, what is frequently charged to "wear and tear" is really due to external corrosion, pure and simple, resulting from sheer carelessness either in

original construction or in subsequent supervision. The author dwells rightly on the great importance of "flue-cleaning" to both engineer and proprietor, giving an instance within his knowledge where the time of raising steam in the morning was 50 per cent. longer when the tubes were unswept for one week than when they were swept three times a week. The "Cyclone Flue-cleaner," of which an engraving is given, and which is manufactured by the "Crescent Company, Cleveland, Ohio," is represented to be an effective machine, "adapted to marine, stationary, portable, upright, and locomotive boilers." The vast amount of earthy matter and impurities which are deposited in locomotive boilers, is not generally realised even by those who are supposed to be conversant with the subject. By way of illustration, the instance is quoted of the locomotive on the New York Central Railway, which runs forty miles and takes in 1,800 gallons of water, or 45 gallons per mile, containing 1½ ounce of earthy matter per gallon, and which, consequently, during its run of nearly 2,000 miles per month, receives no less than 2,004 lb. of incrusting matter annually.

The observations on the effect of water on steam boilers are very instructive, and amongst the materials used to prevent corrosion, Mr. Davis states that zinc has proved the most efficacious, and that it is used by some of the most prominent of Liverpool engineers in their steel boilers. The mode of applying zinc patented by Mr. Hannay, of Glasgow, is spoken of as a very effective adaptation of the material. The chapters alloted to a description of the various machines invented for purifying water for boilers, are well worthy of study, as also the remarks on anti-incrustation compounds, as well as those on the mistake which is commonly made in drawing the fires at the end of the week's work, and at once blowing off water and steam instead of only closing the damper and ash-pit doors, and allowing everything to remain until morning, when the water can be let off, and the inside of the boiler be got at and thoroughly cleaned out. In cases where hand cleaning is not practicable, Hotchkiss's mechanical boiler-cleaner is declared to be the most effective instrument yet manufactured. We cannot doubt but that Mr. Davis's work will be appreciated as a valuable contribution to the special subject of which it treats.

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*London and Provincial Water Supplies.* By ARTHUR SILVERTHORNE, A.M.I.C.E. London: Crosby Lockwood & Co.

WE have lately had before us several pamphlets relating to the water supply of London in its various aspects, and in so far as statistical information is concerned no new facts are brought forward by Mr. Silverthorne which call for particular notice; but by combining the statements of the provincial water supplies in the same volume, he renders possible a comparison of the results of the London Water Companies with those of other private undertakings, and of the schemes which have been carried out by various corporations. One result of such a comparison is to show that most of the provincial towns, though charging higher rates, furnish in no cases rentals even approaching a corresponding extent to those yielded by the London districts. The large discrepancy observable would, it is said, on careful inquiry, be found to result from the existence in the metropolis of a multiplicity of charges, beyond the mere rate per cent. on annual value, which are made on consumers that have no existence elsewhere, but which contribute materially in the aggregate to swell the rental to undue proportions.

Seeing that the metropolitan companies in 1882-83 divided no less than 8·75 per cent. amongst their shareholders, and that there is a large annual increase to their business, the consumers may fairly look for material concessions from them; and to this end might submit their representations to the Legislature, who, though not likely at present to alter the statutory rates originally settled, may yet, at no distant date, see the way to insisting on a reduction.

The principal interest of this publication lies in the particulars afforded of the provincial supplies. It appears that neither the old-established companies nor the corporations pay larger dividends than five or six per cent. This is accounted for by their having to meet two requirements from which the London companies are exempt, viz., the redemption of capital, and the compensation clauses which Parliament compels the towns to submit to in cases where large extensions have had to be made to such schemes as, originally insufficient in their own resources, have been bought up by municipalities at a high premium, thereby greatly enhancing their cost. The compensation frequently far exceeds the supply applicable to the district, notably so in the town of Bolton, where it amounts to nearly double the volume delivered to the town itself for all purposes. In the course of his remarks, Mr. Silverthorne reproduces a part of the address given a few years ago by the late Sir W. Fergusson to the British Medical Association at King's College, on the subject of an efficient water supply, the perusal of which we would commend to the attention of all those consumers who may have become alarmed by the forebodings which have recently been so thoughtlessly advanced on the question of water purity. A fund of useful information will be found in the carefully-tabulated statements relating to the provincial supplies which make up the greater portion of the volume.

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## VARIORUM.

THE miniature memorandum-book noticed by us with approval a fortnight ago is entitled: "Smith's Tables, Memoranda, and Calculated Results," selected and arranged by Francis Smith. The publishers are Messrs. Crosby Lockwood & Co.——Sprague's Pocket Diary (Sprague & Co., Martin's-lane, Cannon-street) is a combination of the ordinary pocket diary in leather case, with a number of tables of formulæ and memoranda such as are useful to architects and surveyors. A great deal is got into a small compass, and the book is a very handy and convenient one.—— Messrs. T. J. & J. Smith (Queen-street, Cheapside), send us a parcel of their useful diaries, of which there is a good variety. Their "Scribbling Diary," No. 7, interleaved with blotting-paper, and their small ditto, No. 6, each of which is sold for a shilling, are among the cheapest and best of their kind. Their "Tablet Diary," which can be hung up, is so arranged as to show a whole week's engagements at a glance, and is exceedingly useful. —— "The Prince of Palms," by W. P. Treloar (Sampson Low & Co.), is a description of the cocoa-nut palm-tree, with some account of its industrial applications, in the development of which Messrs. Treloar & Sons have taken a leading part. The book contains some well-executed illustrations. —— Messrs. Cassell & Company (Limited) send us a packet of their monthly publications. The "Technical Educator" contains lessons in object-drawing and perspective, freehand drawing for stonemasons, and papers by Dr. Dresser on the principles of design. "The Practical Dictionary of Mechanics," by Edward H. Knight, C.E., is a very useful but very voluminous work of reference; for, although the part now to hand is the 97th, the work has not yet gone beyond the letter D. It is fully illustrated, and authorities and references are given apparently with great care. The work is of American origin, and this will account for some eccentricities of spelling. Cassell's "Universal History" has reached its 40th part, and "Picturesque America," its 46th part,—the latter including illustrations of scenes in Chicago, which afford glimpses of the street architecture of that newly-built city.

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## RECENT PATENTS.

### ABSTRACTS OF SPECIFICATIONS.

2,374, Improvements in Zinc Roofing. J. & J. Mould.

In this adaptation of corrugated roofing to flat surfaces, simplicity and ease of construction have been considered as well as the desirability of making a roof which shall be water-tight. The edge of each sheet is turned upwards into a double curve or corrugated flange, the edge itself finishing with an outward curve from the rafter ridge or other projections, as the case may be. Over the upper curls or corrugations formed by the flanges of two such sheets coming together on each side of a rafter or other projection, two or more saddles are made with a slight curve at the top, and the sides returning inwards, so as to spring under the upper curl of each plate, the edges of the saddles then spreading outwards, and lying smoothly upon the roof of the lower corrugation, so that great freedom and smoothness of action is allowed to the sheets. These saddles are secured in their position by means of zinc intermediate blocks, which rest on the rafters or other projections, and support the saddles under the upper part, screws passing through both the saddle and zinc block into the rafters or ridges or other projections secure the saddle down at the top, but leave the sides perfectly free. Lateral movement is prevented by securing the ribs, and a cover plate is provided at the junctions.

2,907, Improvements in Bricks. H. W. Hart.

This is an extension of a somewhat similar invention of the same patentee, wherein the bedding and butting faces of bricks used for building are formed alternately with broad grooves or recesses tapered at the sides and with projecting pieces or joggles to fit into these recesses. To reduce the quantity of mortar or cement required in laying such bricks and to cheapen their cost and increase their strength, two square pockets, the sides of which are tapered, are formed, and two corresponding projections or joggles are also formed on the opposite side. These projections and recesses being made in each brick, a great saving of mortar or cement is effected, and the bricks being laid much closer, their strength is greatly increased.

3,329, Improvements in Fixing Rainwater Gutters, &c. G. Kay.

The ordinary half-round gutters are laid loosely into the hooks, which are fixed to the roof, but in this invention a hoop-iron circular clasp, strung on the same bolt as the spigot and faucet, holds down the guttering and prevents its removal by storms or pressure from rains or wind.

4,725, Flushing Sewers. P. Burke.

Relates to flushing, cleaning, and purifying sewers. Piles of waste material usually accumulate on level parts of sewer; a pipe runs along the roof of sewer, from the underside of which short curved nozzles, which direct the water jets in the direction of flow of the liquid in the sewer. Manholes are provided for clearing out the solid waste, and short sections of flushing pipes are provided into which water is successively turned.

### APPLICATIONS FOR LETTERS PATENT.

*Dec.* 19, 1884.—16,670, J. C. Webb and F. D. Smith, Screw Collar Joint for Sewer and Drain Pipes.—16,672, E. G. Wright, Chimney Cowl and Ventilator.—16,679, G. Collings, Improved Sash Fastener.—16,687, H. G. Bridge, Apparatus for Facilitating the Sharpening of Plane Irons, Chisels, and other Edge Tools.—16,696, F. H. Moore, Improvements in Fire Grates, Stoves, &c.—16,709, J. White, Chimney Cowls and Ventilators.—16,712, H. H. Lake, Improvements in Flooring Cramps.

*Dec.* 20.—16,740, J. C. Bloomfield, Method and Material for Joining Earthenware Pipes.—16,745, C. F. Veit, Improvements in Locks.—16,754, A. A. King, Fastening Water-closet Doors.

*Dec.* 22.—16,771, T. Broomhall and J. Broomhall, Sash Fastener, also applicable to other purposes.—16,772, J. Walker, Box Slides for Door Chains.—16,774, H. Sutcliffe, Machine for the Manufacture of Lavatory Basins or Cabinet Stands.—16,775, H. Smith, Fireproof Passages, &c.—16,781, J. Walker, Window Sash Fasteners.—16,790, U. A. Williams, Improved Window Sash Fastener.—16,791, P. R. Shill, Apparatus for Cutting or Planing Wood.—16,792, G. Ross, Laying and Securing Slates.—16,812, J. L. Lobley, Ventilation.—16,817, R. Adams, Opening and Closing Fanlights, Skylights, Ventilators, &c.—16,818, M. P. Ismay, Automatic Closing of Doors.

*Dec.* 23.—16,821, J. H. Hubert and T. Colley, Sash Bar Cramps for Carpenters, Joiners, &c.—16,851, A. Emley, Improvements in Cooking Ranges.—16,860, H. N. Marks, Self-acting Water Closet.—16,862, G. Pepper, Improvements in Lavatory or Washhand Basins.

### PROVISIONAL SPECIFICATIONS ACCEPTED.

9,405, W. H. Luther, Sash-bars or Astragals. — 15,161, W. Scott Morton, Embossed Canvas for Decorating Walls or other Surfaces.—15,450, E. C. Murray, Room-to-room Communicator. — 15,520, H. J. Hadden, Limestone and Cement Kiln.—15,825, J. Walker, Manufacture of Turn Buttons and Plates for Fastening Doors and Windows.—15,928, G. Heward, Improvements in Cooking and other Kitchen Ranges. — 15,945, J. J. Talman, Attaching Door-lock Handles to their Spindles.—15,955, W. H. Willett and T. C. Wakeling, Improvements in Fire-grates.—15 976, E. R. Hollands, Open Stoves or Fire-grates.—16,075, J. B. Better, Improvements in Chimney-tops.—16,187, G. F. Williams and W. C. Horne, Luminous Letters and Signs.

### COMPLETE SPECIFICATIONS ACCEPTED.

*Open to opposition for two months.*

226, J. Walsh, Improved Ventilator.—3,521, C. Schlickeysen, Improvements in Roofing Tiles.—4.164, H. Tosh and S. Preston, Opening and Closing Window-sashes and Fanlights.—4,533, J. King, Chimney Cowls and Ventilators.—4,583, W. Reynolds, Combination Tool.—7,620, T. Abbott and M. Hawthornthwaite, Flushing Apparatus for Water-closets and Sewers. — 13,841, J. Ennals, Combination Water-closet and Dust-bin.

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**Re-Valuation for Assessment.** — The Assessment Committee of the Blean Union (Kent) have selected Mr. Chas. F. Jones, F.S.I., to re-value the railways, and gas and water works companies throughout their Union.

## MEETINGS.

FRIDAY, JANUARY 2.

*Architectural Association.*—Discussion on "The Best System of Professional Education for Architectural Students, and How the Work of the Association might be Rendered More Efficient." 7·30 p.m.

SATURDAY, JANUARY 3.

*Association of Public Sanitary Inspectors* (1, Adam-street, Adelphi).—Mr. Edward C. Robins, F.R.I.B.A., will read a paper entitled "The Growing Importance and Responsibility of Public Sanitary Inspectors explained, and their relative Improvement in Education, Position, and Emoluments considered." 6 p.m.

MONDAY, JAN. 5.

*Royal Institute of British Architects.*—Business Meeting. The Report of a Visit to Vienna and Buda-Pesth by Mr. F. R. Farrow, holder of the Godwin Bursary, will be presented. 8 p.m.

WEDNESDAY, JAN. 7.

*British Museum.* — Mr. W. St. Chad Boscawen on "Assyrian and Babylonian Antiquities." 2·30 p.m.

*British Archæological Association.*—Mr. C. Lynam on "Recent Excavations at Hulton Abbey." 8 p.m.

THURSDAY, JAN. 8.

*Society of Antiquaries.*—Ballot for Election of Fellows. 8·30 p.m.

## Miscellanea.

**Building on Disused Burial-Grounds.**—Taken in conjunction with the ravages and recent decline of cholera in Paris and on the Continent generally, and with our own immunity so far from that justly dreaded disease, the recent judgment by Mr. Hannay, since confirmed by a superior court, with reference to the opening up of the Old Peel Burial-ground in Bethnal-green must appear to be one of very questionable propriety. In opposition to the Metropolitan Board of Works, he has maintained that the area in dispute does not come within the operation of a by-law of the Board, which forbids the use for building purposes of land impregnated with animal or vegetable matter before the removal of the soil so affected, and he has accordingly sanctioned the erection of buildings upon it. Now, the Old Peel Burial-ground was during the cholera epidemic of 1849 literally packed with the remains of the victims of this malady. There is nothing to show to what extent the contagion then entombed has been starved out of existence during the subsequent period in which the ground has been unused. It may very well be that, under the favouring conditions of sufficient heat and moisture which the earth of cemeteries is known to furnish, the germs of disease are still preserving a subterranean life. There is no slight risk in such a case that the drainage and water-supply of the houses to be built at this spot will become the conduits of infection. It were therefore better, in our view, that a soil once so impure should be left altogether undisturbed; but if the time for this possibility is past, there only remains the greater necessity for the removal of all contaminating matters and the thorough disinfection of the sites to be occupied. These observations, which apply in a special degree to the case before us, have, moreover, a practical significance which should not be forgotten in dealing with the same subject in all its aspects.—*Lancet.*

**New Artisans' Dwellings in Lambeth.**—A block of buildings for the industrial classes has just been erected in Walnut Tree Walk, off Kennington-road, Lambeth. The buildings, which are in two blocks, have a frontage to Walnut Tree Walk 40 ft. in length, and extend to a depth of 100 ft. They contain four floors, and are 50 ft. in height. The elevation is faced with white Suffolk brick, and the frontage is ornamented with moulded and cut brick panels by Mr. James Brown, of Finsbury. The keystones, copings, and finials are in Portland stone. Each floor contains four sets of apartments, in suites of three rooms each, consisting of living-room, bedroom, and kitchen, with separate water-closets to each suite. The living-rooms are fitted with two cupboards, and there is one in each of the bedrooms, whilst the kitchens, in addition to dressers and cupboards, are supplied with coppers, sink, and coal bunker. There are stone staircases from the ground to the upper floor. The open flat roof, which is intended for both drying and recreation purposes, is constructed of concrete slabs and cement, and enclosed by a parapet wall 4 ft. in height. Messrs. Stock, Page, & Stock, of Duke-street, London Bridge, are the architects, and Messrs. J. Ford & Sons, of Denmark-hill, are the contractors. The cost of the buildings, which have been erected for Mr. Mackenzie, is 4,000*l.*

**Civil and Mechanical Engineers' Society.**—An Ordinary Meeting of this Society was held on the 31st ult., the President, Mr. Thomas Cole, in the chair, when a paper was read by Mr. J. Tertius Wood, C.E., entitled "Criticisms on the Storage of Towns Water." The author said that the introduction of subsidiary pounds to catch what would otherwise be flood or waste water, was a feature introduced by him to equalise as far as possible the unequal distribution of rainfall during the year, and assist in employing the utmost available yield from a surface-drainage catchment-area, and remarked that of course an open reservoir can be constructed to hold a volume of water calculated to expend itself during a considerable period of abnormally dry weather; but such a reservoir might, for many months, be in a low and somewhat stagnant condition: so similar results may be obtained by having covered pounds adjacent to the reservoirs, and connected therewith by culverts, having floor-levels on the same horizontal plane as the sill of the overflow; that, when the reservoir had reached its limit of capacity, the pounds would commence to fill, and the water therein contained would be removed from evaporative rays, and kept cool and wholesome. The author further remarked that it has now become necessary that steps should be taken to institute a thorough inquiry into the whole question of water supply, and, as a sanitary unit, be kept parallel with the uses to which it has to be applied; and he said that this past year has been fruitful in causes and effects, and has practically illustrated the dangers likely to arise from a forgetfulness of its importance as a social and mercantile commodity.

**Arvernian Architecture.**—A typical Arvernian church has a character of its own which it is impossible to mistake. As a rule, a square tower at the west end and an octagonal tower in the middle suggest to an English eye a faint analogy to Ely or Wymondham. Very faint, indeed, the analogy is to either; still the square and the octagon are there, however much their proportions may differ from the proportions of the square and the octagon in the only two English churches with which we can compare them. The Arvernian central octagon has a strange look in the way in which it rises, not immediately from the four limbs of the church, but from a kind of oblong base which it is not easy to describe, but which is one of the most marked characteristics of the style, within and without. The truth is that the innermost bay, so to speak, of each transept, those which in the ground-plan range with the aisles of the eastern and western limb, are carried up to the full height of the lantern. Outside, this gives the tower this broad base to spring from; if the tower was away, it would have a good deal of the effect of the high choirs of the Cistercian churches in Sicily. Inside, it increases the effect of height, and it further supplies a new pair of lofty arches to increase the complication of grouping, and of arches crossing one another, some measure of which is necessarily found in every cross church. The effect of this very singular arrangement is, to our taste, certainly much better inside than it is without.—"E. A. F.," in the *Guardian.*

**Lowe's Wood-block Flooring.**—The excellent wood-block flooring patented by Mr. R. L. Lowe, of Farnworth, near Bolton, has been used for the following, among many other new buildings, viz.,—corridors and council-chamber at Hyde Town-hall, Messrs. J. W. & F. R. Beaumont, architects, Manchester; Hanley Town-hall, Mr. J. Lobley, surveyor; Girls' High School, Exeter, Messrs. Hayward & Son, architects, Exeter; dispensing-room, Beckett's Hospital, Barnsley, Messrs. Dixon & Moxon, architects, Barnsley; floor of chapel in oak, also kitchen in red pine, Memorial Home, Liverpool, Mr. A. Waterhouse, architect, London; restaurant, Hatchett's Hotel, Piccadilly, Messrs. Weatherley & Jones, architects; waiting-room, Leamington Avenue Station, Leamington, for the London and North-Western Railway Company, Mr. H. Woodhouse, C.E., Stafford. It has been largely used for school floors, and has given great satisfaction.

**Obituary.**—It is with regret that we have to announce the death of Mr. John Fraser, jun., which took place on Monday last, after a lingering illness, at his residence, Don Cottage, Woodside, Aberdeen. He was thirty-five years of age and was one of the firm of John Fraser & Son, Granite Quarry owners and workers of that city.

**New Buildings in Queen Victoria-street.**—A lofty block of new buildings is at present in course of erection at the junction of Queen Victoria-street and Upper Thames-street, on the site of Muggeridge's granaries. With the view of widening Upper Thames-street at its western entrance, the Corporation some time ago purchased the old buildings, which were taken down, and the greater part of the site has been let on a building lease. Upper Thames-street at its western entrance will be widened to the extent of 4 ft. The new building will have three lofty frontages, one facing Queen Victoria-street, another on the west side, and the third on the south side, in Upper Thames-street. The Queen Victoria-street and west frontages will be 68 ft. in height from the street line, and will contain five lofty floors in addition to the basement, whilst the Upper Thames-street frontage will (owing to difference of level) be 78 ft. high, containing six floors and basement. The Queen Victoria-street frontage is 60 ft. in length, and is faced with Portland stone. The west frontage, 40 ft. in length, is strictly uniform with the Queen Victoria-street elevation. The Upper Thames-street frontage is faced with white Suffolk brick and Portland stone dressings. The lower part of this frontage contains what is termed the lower ground-floor,—the Thames-street level being much lower than that in Queen Victoria-street,—and that in Queen Victoria-street the upper ground-floor. Mr. W. Wimble is the architect, and Mr. W. Brass, of Old-street, is the contractor. Mr. Hayes is clerk of the works, and Mr. Eve the foreman. The cost of the building will be about 15,000*l.*

**The Destruction of Bricks through the Action of Bacteria.**—The *Riga Industrie Zeitung* has lately commented upon the statement on the above subject (quoted in the *Builder* of May 31, 1884, p. 802), which has been circulated by the technical press of the Continent. Herr Glasenapp considers that in the assertion referred to cause and effect have been confounded, as such germs can only be developed where they find nourishing-grounds containing organic substances in abundance, and how a brick which has been burned in the normal manner should contain germs it is hard to understand. If, however, the brick has been injured by the weather, becoming soft and porous, it is easily penetrated by dust (which may be partly organic), and if damp then supervenes the necessary conditions are present for the development of bacteria, which by their action hasten the process of destruction. It has even been proposed to disinfect bricks, but this, it is remarked, would be as devoid of efficacy as the proposed disinfection of coins. In fact, any object exposed to the air for a short time would be found on microscopic examination to contain bacteria, many of which are perfectly harmless. It is considered probable that the germ in question is the *Bacterium termo* (Cohn), which is found on most articles of food, and is the germ of decomposition *par excellence.*

**Dry-Rot in Wood.**—The official *Zeitschrift für Bauwesen* contains a treatise on the above subject by Professor Sorokin, of Kajan, dealing with the various parasitical destroyers of wood, and particularly the dry-rot (*Merulius lacrymans*). The anatomical structure and other details as to this parasite are described with clearness, and a series of twenty-seven illustrations gives views of infected wood and representations of the parasite in various stages of its development. The remedies proposed are described as follows:—1. A current of air destroys the parasite in twenty-four hours. 2. Light is also an obstacle to its growth. When exposed to the simultaneous action of light and a draught of air, drying up ensues within a few hours. 3. The sprinkling of wood with a solution of common salt prevents the appearance of dry-rot. The greater the concentration, the more durable is the protective effect. 4. A solution of sulphate of copper (particularly if concentrated) is preferable to the solution of common salt. 5. Carbolic acid destroys the *merulius* very rapidly. 6. Ordinary birch-tar is a very efficacious agent against dry-rot. The beams and interior surface of the boards should be coated with it. Its economy and the simplicity of its application render birch-tar one of the most convenient and practical means of obviating the entire question.

**Lectern for Aston Church.**—A polished brass eagle lectern has just been presented to the ancient parish church of Aston, near Birmingham. It has been manufactured by Messrs. Jones & Willis, of Birmingham and London.

**Locks.**—The locks at Hatchett's Hotel were made by Messrs. Hobbs, Hart, & Co., for special master-key to pass each floor separately, with a special key for each lock, all distinct throughout the building, and a principal master-key to pass all locks throughout the hotel, which is a similar arrangement to those carried out by the same firm to the Grand Hotel, Charing-cross (over 400 locks); and the First Avenue Hotel, in Holborn (over 500 locks). Messrs. Hobbs, Hart, & Co. are now making a similar arrangement for the Hôtel Métropole, in Northumberland Avenue (over 750 locks), consisting of eight distinct special master-keys for the various floors, distinct special keys to differ to each lock throughout, and principal master-key to pass all, for proprietors' use in case of fire, or otherwise to obtain access to all doors throughout the entire hotel.

**Tenby Winter Garden.**—A short time since the town of Tenby, in South Wales, decided to raise sufficient funds to erect a winter palace, garden, concert-hall, salt-water swimming-baths, &c. The matter was warmly taken up by the inhabitants, and an influential committee was formed to carry out the project. The first step to enable the committee to carry out the undertaking was to obtain designs for the scheme. This they decided should be by open competition among engineers and architects, and several designs were sent in. The committee charged with the selection of a design has chosen the one sent in by Messrs. Whitmore & Reeves, architects, Devonshire-square, Bishopsgate, London, and Chelmsford, who have been instructed to prepare working plans, and complete the designs of the undertaking to place before the Board of Trade.

**Covers for Manholes, &c.**—Mr. T. Durrans, architect, sends us the specification and drawing of his patent cover for manholes and other openings to cesspools, sewers, &c., which is, in fact, a screw cover, with either truly turned bevilled edge and seat, or with an elastic compressible medium to secure tightness of the joint.

**Erratum.** — The premiated design for the Newcastle Infectious Hospital, illustrated last week, was by "Messrs. Bradshaw & Gass," architects, of Bolton, and not by "Mr. J. Bradshaw Gass."

## COMPETITIONS, CONTRACTS, & PUBLIC APPOINTMENTS.

*Epitome of Advertisements in this Number.*

### COMPETITIONS.

| Nature of Work. | By whom required. | Premium. | Designs to be delivered. | Page. |
|---|---|---|---|---|
| Manufacturing Premises | Not stated | 100 guineas, first; 30 ,, second; 20 ,, third | Jan. 15th | ii. |
| Street Improvements | Croydon Corporation | 100*l.*, 50*l.*, and 25*l.* | March 25th | ii. |

### CONTRACTS.

| Nature of Work, or Materials. | By whom required. | Architect, Surveyor, or Engineer. | Tenders to be delivered. | Page. |
|---|---|---|---|---|
| Erection of Business Premises, &c., Canterbry | Cox & Ellyet | J. Cowell | Jan. 3rd | xxxii. |
| Taking Down Old Buildings, Cleaning Site, Building Vaults, &c. | Vestry of St. Mary Abbotts, Kensington | W. Weaver | Jan. 6th | xxxii. |
| Erection of House and eight Cottages, Rogiet | Great Western Railway | | do. | ii. |
| Road-making and Paving Works | Fulham Board of Wrks | The Surveyor | Jan. 7th | ii. |
| Paving, &c. | Mile End Vestry | J. M. Knight | do. | xxviii |
| Supply of Materials | Liverpool Corporation | *Official* | Jan. 10th | xxxiv |
| Kerbing, Tar-Paving, &c. | Lewisham Brd. of Wks. | | Jan. 13th | xxviii |
| Removal of Dust, Dirt, Ashes, &c. | Crown Est. Pav. Com. | *Official* | Jan. 14th | ii. |
| Laying Tramways | Blackpool Corporation | T. Sunderland | do. | xxviii |
| Construction of two Bridges, Lenton | Midland Railway Co. | A. A. Langley | Jan. 15th | ii. |
| Supply and Erection of Ironwork for Bridges | do. | do. | do. | ii. |
| Coal Store, &c., S. Western Fever Hospital | Met. Asylums Board | M. Wyatt | do. | ii. |
| New Offices, &c., | Barnsley British Co-Operative Society | W. Senior | Jan. 16th | ii. |
| Water Supply (Cast-Iron Pipes) | Claines Local Board | A. H. Parker | Jan. 21st | xxxi. |
| Water Supply (Pipe Laying) | do. | do. | do. | xxxi. |
| Erection of Engine-House, Middlesbrough | North Eastern Railway | W. Bell | do. | ii. |
| Erection of Engine-Shed, St. Helen's Junct'n | do. | do. | do. | ii. |
| Paving Works | East Retford U. S. A. | J. D. Kennedy | Jan. 23rd | xxxii. |
| Sewerage Works | Normanton Local Brd. | T. Reid | do. | xxxi. |

### PUBLIC APPOINTMENTS.

| Nature of Appointment. | By whom Advertised. | Salary. | Applications to be in. | Page. |
|---|---|---|---|---|
| Borough Surveyor | Corporation of Bolton | Not stated | Jan. 6th | xxvii. |
| Inspector of Drainage Works | Teignmouth Local Brd. | Not stated | Jan. 10th | xxvii. |

## TENDERS.

For constructing a 3 ft. 6 in. by 2 ft. 4 in. brick sewer, Markfield-road, to junction of Lordship-lane with High-road, for the Tottenham Local Board of Health. Mr. W. A. H. de Pape, engineer and surveyor. Quantities by Messrs. J. S. Lee & Son, Craven-street, Strand:—

| | |
|---|---|
| Prouse & Lee, Broad-street-buildings, E.C. | £10,268 0 0 |
| J. McKenzie & Co., Finsbury | 8,955 0 0 |
| J. Botterill (informal), Cannon-street | 8,791 0 0 |
| J. Pizzey, Hornsey | 8,747 0 0 |
| Bottoms Bros., Lavender-hill | 8,681 0 0 |
| Geo. Cowderry, Newent, Gloucestershire | 8,315 0 0 |
| J. Stone, Tottenham | 8,129 11 0 |
| C. Taylor, Holloway | 7,949 19 0 |
| W. Schofield, Bucklersbury | 7,300 0 0 |
| Geo. Bell, Tottenham | 6,776 0 0 |
| B. Cooke & Co., Battersea | 6,682 0 0 |
| Nowell & Robson, Kensington | 6,273 0 0 |
| J. Bloomfield, Tottenham (accepted) | 5,776 1 5 |

[Engineer's estimate, £6,876.]

For completion of the Paddington Infirmary, Harrow-road, for the Guardians of the Poor of the Parish of Paddington. Messrs. A. & C. Harston, architects, 15, Leadenhall-street, E.C. Quantities supplied:—

| | |
|---|---|
| Bray & Pope | £7,500 0 0 |
| J. Garlick | 7,163 0 0 |
| W. S. Josolyne | 6,755 0 0 |
| Killby & Gayford | 6,722 0 0 |
| J. Marten | 6,711 2 2 |
| F. Higgs | 6,250 0 0 |
| W. Shurmur | 5,940 0 0 |
| Jas. Longley | 5,917 3 11 |
| Howell & Son | 5,890 0 0 |
| Wm. Johnson, Wandsworth-common* | 5,360 0 0 |

* Accepted.

For kerbing, channels, and brick paving, for the Enfield Local Board:—

| | Norway* Kerb. | Aberdeen Kerb.* | Granite* Channels | Blue Brick Paving.† |
|---|---|---|---|---|
| | s. d. | s. d. | s. d. | s. d. |
| Parker, Nottingham | — | 2 2 | 6 3 | 3 9 |
| Almeny, Ponders End | 2 10 | 3 0 | 4 10 | 4 10 |
| Hirst, London | 2 2½ | 2 6 | 6 0 | 2 6 |
| Nowel & Robson, Kensington | 2 5 | 2 5 | 6 3 | — |
| Fairhead, Enfield | 2 6 | 2 10 | 5 10½ | 3 9 |
| A. Catley, London | 1 11½ | 2 1½ | 5 2 | 3 7 |
| Nicholls, Wood Green | 2 4 | 2 5 | 5 6 | 3 7 |
| G. Bell, Tottenham | — | 2 3 | 5 0 | 4 4 |
| Patman, Enfield | 2 11 | 3 2 | 6 6 | 4 3 |
| Mowlem & Co., Westminster | 2 1 | 2 4 | 6 3 | 3 10 |
| J. Gabriel, Lambeth | 1 11½ | ... | 4 5 | 5 0 |
| Jackson, Enfield (accepted) | 2 0 | 2 2½ | 4 6 | 2 10 |

* Per foot run. † Per yard super.

For road and sewer on Southborough Park Estate, Surbiton. Mr. Pinel, surveyor:—

| | |
|---|---|
| Searce & Son | £5,277 0 0 |
| Nowell & Robson | 4,196 0 0 |
| Chafen | 4,000 0 0 |
| Jarvis | 3,895 0 0 |
| Pellen | 3,830 0 0 |
| Bath & Blackmore | 3,800 0 0 |
| R. & G. Neal | 3,786 0 0 |
| J. Neal | 3,700 0 0 |
| Mayo | 3,692 0 0 |
| Kavanach | 3,598 0 0 |
| Felton | 3,585 0 0 |
| Rigby | 3,550 0 0 |
| Hare | 3,550 0 0 |
| Nichols | 3,525 18 0 |
| Ball | 3,400 0 0 |

For the erection of the church situate in the Holmes, Doncaster, from designs by Sir Edmund Beckett, bart.:—

| | |
|---|---|
| Mesdows, Stockport | £4,699 0 0 |
| Burnby, Sheffield | 4,640 0 0 |
| Rodley & Sons, Sheffield | 4,512 8 0 |
| Willson, Retford | 4,454 0 0 |
| Harrison, Sheffield | 4,312 5 0 |
| Snell, Masbrough | 4,170 0 0 |
| Ropley, Rotherham | 3,440 0 0 |
| W. Anelay, Doncaster | 3,379 0 0 |
| Wortley, Doncaster | 3,184 5 0 |
| Athron Bros. & Gill (accepted) | 3,160 0 0 |

For the erection of a villa, for Mr. H. Tylor. Mr. F. T. Mercer, architect. Quantities supplied:—

| | |
|---|---|
| Warton & Walker | £1,190 0 0 |
| Laughton | 1,165 0 0 |
| Foster | 1,100 0 0 |
| White | 1,063 0 0 |
| Harrison | 1,040 0 0 |
| George | 975 0 0 |
| Sharrett | 925 0 0 |

For the erection of sheds in the parish yard, Richmond, Surrey. Mr. Walter Brooke, C.E., town surveyor:—

*Contract No.* 1.

| | |
|---|---|
| Steere, Richmond | £269 0 0 |
| Carless & Co., Richmond | 166 0 0 |
| Sweet & Loder, Richmond (accepted) | 143 17 0 |
| Carman, Richmond | 139 10 0 |

*Contract No.* 2.

| | Fireproof. | Galvanised Roof. |
|---|---|---|
| Sweet & Loder, Richmond | £37 0 0 | £27 0 0 |
| Pierce (Carless & Co.), Richmond* | 37 0 0 | 27 0 0 |
| Sims, Richmond | 35 10 0 | 29 10 0 |

*Contract No.* 3.

| | |
|---|---|
| E. Hawkins, Richmond | £385 0 0 |
| Collings & Son, Richmond | 312 15 0 |
| C. Eldridge, Richmond | 285 0 0 |
| T. Sims, Richmond | 270 0 0 |
| C. H. Pennington, Richmond | 266 0 0 |
| Sweet & Loder, Richmond | 265 0 0 |
| C. Maton, Kew | 249 0 0 |
| Carless & Co., Richmond (accepted) | 243 0 0 |

* Accepted.

For alterations to the premises lately known as the Berkshire Brewery, situate in King-road, Reading, for Messrs. J. Salmon & Son, tea merchants. Messrs. Brown & Albury, architects:—

| | |
|---|---|
| W. Woodroffe | £1,757 0 0 |
| T. H. Kingerlee | 1,640 0 0 |
| George Wernham | 1,500 0 0 |
| H. Higgs | 1,477 0 0 |
| J. Bottrill | 1,450 0 0 |
| George Searle | 1,414 0 0 |
| S. Denton (accepted) | 1,353 0 0 |

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| | |
|---|---|
| S. Deacon (accepted) | £450 0 0 |

For new billiard-room at Balmore, Caversham, Oxon, for General Radcliffe. Messrs. Brown & Albury, architects:—

| | |
|---|---|
| Henry Higgs, Reading | £916 0 0 |
| W. Woodroffe, Reading | 815 0 0 |
| Geo. Wernham, Reading* | 785 0 0 |
| A. W. Dodd, Caversham† | 628 10 0 |

* Accepted, subject to alterations, reducing amount to 750*l.* † Error in estimate.

For alterations and additions to No. 1 School, Chigwell, row, Essex, for the Chigwell School Board. Mr. Edmund Egan, architect, Loughton. Quantities by the architect:—

| | |
|---|---|
| R. & W. Foster | £1,303 16 9 |
| R. G. Walter | 1,282 1 2 |
| C. H. Stuart | 1,146 12 4 |
| W. Watson | 1,141 13 10 |
| G. Flaxman | 1,133 0 0 |
| Scharien & Williams | 1,089 0 0 |
| Henry Wells | 1,038 0 0 |
| J. J. Robson (too late) | 1,016 0 0 |
| W. Knight | 999 0 0 |
| J. Baxter (too late) | 996 0 0 |
| John Egan | 989 0 0 |
| S. Scott | 972 0 0 |
| C. Barnes | 963 0 0 |
| George Parker (accepted) | 949 0 0 |

For additions to Sunnymead House, Colchester, for Mr. Bart. Rous. Mr. Stark Wilkinson, architect, Furnival's Inn, London:—

| | |
|---|---|
| A. Chambers | £299 0 0 |
| J. Malster | 290 0 0 |
| R. Eade | 230 0 0 |
| F. Dupont | 215 0 0 |
| C. H. Oldridge (accepted) | 212 0 0 |

For proposed extension of the Jews' Infant School, Commercial-street, Whitechapel, E., for the Jews' Infant School Committee. Messrs. Davis & Emanuel, architects, No. 2, Finsbury-circus, City, E.C. Quantities supplied by Mr. H. P. Foster, 5, John-street, Adelphi, W.C.:—

| | |
|---|---|
| Clark & Bracey | £3,816 0 0 |
| Colls & Sons | 3,680 0 0 |
| G. S. S. Williams & Sons | 3,667 0 0 |
| Mark Gentry | 3,590 0 0 |
| J. Grover | 3,548 0 0 |
| S. J. Jerrard | 3,484 0 0 |
| E. Conder | 3,430 0 0 |
| Lawrance & Sons | 3,325 0 0 |
| Harris & Wardrop (accepted) | 3,293 0 0 |

For roads and sewers on portion of Southborough Park estate, Surbiton. Mr. C. J. Bentley, surveyor:—

| | |
|---|---|
| Chafen | £2,000 0 0 |
| Kavanagh | 1,965 0 0 |
| Hampton | 1,910 0 0 |
| Peller | 1,893 0 0 |
| R. & G. Neal | 1,883 0 0 |
| Rigby | 1,690 0 0 |
| Nichols | 1,651 11 6 |
| Nowell & Co. | 1,621 0 0 |
| Hare | 1,577 0 0 |
| Mayo | 1,574 14 6 |
| Felton | 1,567 0 0 |
| Ball | 1,100 0 0 |

For the erection of new District Church, Windmill-hill, Redminster, Bristol, exclusive of the upper part of the Tower. Mr. C. Henry Edwards, architect, Bristol and Weston-super-Mare :—

| | | | |
|---|---|---|---|
| Stephens & Bastow | £6,100 | 0 | 0 |
| E. C. Howell & Sons | 6,760 | 0 | 0 |
| A. J. Beaven (accepted) | 5,900 | 0 | 0 |

For cleaning and stacking all old bricks and clearing site of the late fire at the Gaiety Theatre, French-street, Southampton, for Messrs. Forder & Co. Mr. W. B. Hill, architect :—

| | | | |
|---|---|---|---|
| Martin | £121 | 0 | 0 |
| Bear | 100 | 0 | 0 |
| Crook | 73 | 10 | 0 |
| Bull, Sons, & Co., Limited (accepted) | 40 | 0 | 0 |

For making new roads and sewers on the Shelley Estate, Boscombe, Bournemouth, for the Boscombe Conservative Co-operative Land and Building Society, Limited. Mr. Reginald G. Pinder, M.S.A., surveyor to the Society :—

| | | | |
|---|---|---|---|
| S. Osborne, Bristol | £716 | 7 | 4 |
| J. Kingswell, Colbourne, I.W. | 629 | 5 | 0 |
| W. Sherwood, Bournemouth | 6 6 | 7 | 6 |
| E. G. Perkins & Co. (contractors, Swanage Railway) | 6 0 | 0 | 0 |
| W. H. Saunders, Bournemouth* | 597 | 5 | 0 |
| G. Trobe, Bournemouth | 575 | 9 | 6 |

[Surveyor's estimate, 6 6*l.* 5*s.* 9*d.*]
* Accepted.

For fitting up the new wing of the Infirmary, Cale-street, Chelsea, with hot-water warming and supply apparatus, for the Guardians of St. Luke's, Chelsea. Messrs. A. & C. Harston, architects, 15, Leadenhall street, E.C. Quantities not supplied :—

*Amended Tenders.*

| | | | |
|---|---|---|---|
| Stidder & Co. | £575 | 0 | 0 |
| G. W. Pratt | 482 | 0 | 0 |
| W. J. Fraser & Co. | 475 | 0 | 0 |
| May Bros. | 447 | 0 | 0 |
| Strode & Co. | 430 | 0 | 0 |
| R. Crane | 427 | 0 | 0 |
| Clements, Jenkes, & Co. | 426 | 13 | 0 |
| Bradford & Co. | 422 | 0 | 0 |
| Kinnell & Co. | 360 | 0 | 0 |
| J. Knight, Westminster (accepted) | 257 | 0 | 0 |

For Abersychan Police station. Messrs. James Seward & Thomas, architects, Cardiff. Quantities by the architects :—

| | | | |
|---|---|---|---|
| D. C. Jones, Gloucester | £1,659 | 0 | 0 |
| T. Foster, Abergavenny | 1,610 | 0 | 0 |
| D. Davis, Cardiff | 1,480 | 0 | 0 |
| J. Burgoyne, Blaenavon | 1,410 | 0 | 0 |
| H. Parfitt, Pontnewydd (accepted) | 1,390 | 0 | 0 |

*SPECIAL NOTICE.*—Lists of Tenders frequently reach us too late for insertion. They should be delivered at our Office, 46, Catherine-street, W.C., *not later than Four p.m.* on THURSDAYS.

## TO CORRESPONDENTS.

E. C. R.—W. M.—G. S. A.—Baron H. de G.—P. D.—C. & C. W.—W. H.—D. and H. (drawing received).—E. C. R.—W. P.—O. P. (thanks).—E. B. J.—T. C. S. (shall appear).—"A Mason" (should send name as well as address).—H. H.

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